(2)

Anal. p. 67.

THE ARTE OF SHOOTING IN GREAT ORDNANCE.

CONTAINING VERY NECESSARY MATTERS for all ſorts of Servitours either by Sea or by Land.

Written by William Bourne.

Robt his

How Cooke 1673

LONDON,
Printed in the yeare, 1643.

TO THE

RIGHT HONOVRABLE

Lord, AMBROSE DUDLEY, Earle of *Warwicke*, Baron of *Liſle*, of the moſt Noble Order of the Garter, Knight, Generall of the Queenes Majeſties Ordnance within her Highneſſe Realme and Dominions, and one of her Majeſties moſt Honourable Privie Counſell, *William Bourne* wiſheth long life, increaſe of Honour, *with all happy ſucceſſe.*

Ight worthy and Noble Earle, whereas I before this time, have written ſundry ſimple Treatiſes, whereof two of them are extant in Print, the one called the *Regiment of the Sea*, and the other, the *Treaſure for Travellers*, and now alſo this barbarous and rude thing, called the *Art of ſhooting in Great Ordnance*; and as it is moſt commonly ſeene, that every perſon doth moſt commonly commend that thing wherein hee is moſt expert; and therefore ſome there are that doe moſt extoll *Divinity*, and great reaſon it is that it ſhould be ſo, for that it teacheth us both to know God, and to inſtruct others: Alſo otherſome doe moſt preferre *Phyloſophy*: otherſome the *Law*, with ſuch like as they moſt delighted in. Alſo other there are, that do not onely extoll them, but will make Arguments, and diſpute, whether of them are moſt commendable, and moſt worthy to bee preferred above the other. There are alſo, that after long diſputation, doe not onely aſſigne every

Science his ſeverall laude and praiſe, but alſo diſcourſe whether of them are moſt neceſſary for a Common-wealth. And I am of that opinion, and that no man can deny, but that the *Art of ſhooting in great Ordnance* is neceſſary to bee advanced for the defence and maintenance of a Kingdome, and Countrey, and the Common-wealth thereof. Wherefore (Right Honourable) being as one extraordinarily bold, I preſent the ſame unto you, for that I know your Lordſhip can truely deſerne and judge in theſe cauſes, as one whoſe wiſdome is not unknowne, hoping that you Honour will take this ſimple worke, as my good will, rather then the value of the thing, or the fineneſſe of the penning of the matter. And thus I ceaſe to trouble your Honourable Lordſhip any longer at this time, deſiring you to accept this ſimple Booke at the hands of a poore Gunner, as a true token of my good will towards your Honour: deſiring God to proſper your Honour in all your doings in perfect health,

By your Honours humbly

at Commandment,

WILLIAM BOURNE.

The Preface to the Reader.

GEntle Reader, it is possible that you would marvel that I should write this booke called the Art of shooting in great Ordnance for two great causes: the one is this: first, for that I have not seene (to most peoples iudgement,) so great experience in these affayers, whereby you may think that I have not knowledge sufficient to be a teacher in these matters. And the second cause is this: for that my order of teaching is contrary unto all that have taken upon them to be teachers, or instructers in these matters or affaires before time. Therefore for to shew unto you the cause that hath moved me to write this rude volume, is this, for that wee English men have not bin counted but of late daies to become good Gunners: and the principall point that hath caused English men to be counted good Gunners, hath bin, for that they are hardy or without fear about their Ordnance: but for the knowledge in it, other nations and countries have tasted better therof, as the Italians, French and Spaniardes: for that English men have had but little instructions, but that they have learned of the Dutchmen, or Flemings, in the time of King Henry the eight. And the chiefest cause that English men are thought to be good Gunners, is this: for that they are handsome about their Ordnance in ships, on the Sea, &c. And furthermore I do think it good to shew unto you three great causes, besides divers other small causes, that the thing that hath letted or hindred English men to become cunning in the shooting of great Ordnance, although divers prooves have bin made at sundry times: and Ordnance hath bin had into the fielde, both in master Bromefields time when that he was Lieutenant of the Ordnance, and at divers times since, and yet those prooves that have bin made then were no profes, but to cause those Gunners that did see the experience of those profes, to committe a further errour as touching the shooting in great Ordnance: and the reason therof is this: the first & principal cause is, that they did make their profe with a Quadrant, and so it ought to be: that is to say, the fourth part of a Circle divided into 90. equal partes, which some simple Gunners wil cal a Triangle, but there is no instrument so called, but only a Quadrant: and the original of the making thereof is the fourth part of a Circle divided into 90 equal partes, what forme so ever that it hath. And now the principal use of the quadrant, is to know what any peece will cast at the mount of every Degree, and so from degree unto degree, unto the best of the Rander. And the cause that hath made the Gunners to commit error by the mounting of the peeces by the degree of the quadrant, hath bin this, although that it be true that such a peece will cast the shot so many scores at the mount of so many degrees, and yet when that they have made proofe therof, they have found it meere false, & yet the thing most true, although somtime the shot hath flien a great deale further, and sometime much shorter, which causes, were no other thing but the highnes or the lownes of the ground, for that there is seldom any ground that you shal find levell, but it will be higher or lower then the ground that the peece standeth upon, as I do more at large declare in the thirteenth chapter of the booke, and yet in the time of service there is no using of the quadrant but in some cases, & then take a great large one, for in a smal you may soone commit errour. And furthermore I do know divers that will have instruments and yet be utterly voide of the uses of them, for it is the reason of the person in the doing of any thing, and not the instrumentes, for in the

doing of any thing, if the perſon doth not conſider of all things with him & againſt him, he or they be apt to commit errour, &c. The ſecond great cauſe is this, in the uſing to give levell with a rule ſet out in inch partes: but unto this they cannot order it, nor give it no Method to know what any peece will doe at any number of inches aduantage, for the peeces do differ in caſting, according unto their lengths, as I doe further ſhew in the booke. Wherefore the uſe of the inche rule, according as they doe uſe it, is to no other purpoſe, but onely to ſeeke out what numbers of inches will reach the marke, and that being known, then to keep the length of the marke with that peece. And the neceſſarieſt thing that this kind of giving of levell in the time of ſervice (as being in a Caſtell, Forte, or Town, or ſuch like, the Gunner having charge of any peece,) is to beate all thoſe markes that be apt to doe any ſervice at, and to know how many inches will reach any marke, &c. but to become a cunning Gunner, he ſhall never be, although he ſhould ſhoote 100. ſhots every day through a yeere, for that he never doth know by that meanes the diſtance of any marke, but in every peece he muſt make a new proofe, if that the peece be removed or changed from that place. Wherefore I have made a table, ſhewing how many inches, and what part of an inch will make a degree, and ſo unto ten degrees wherby you may make a Methode to hit the length of the marke in any peece at the firſt ſhot, as it doth appeare in the eight chapter of the booke, if ſo be that there were a true & exact table of proportion, of the caſting of the peece at the mount of every degree, but I have not had ſo great proofe but that I may be deceived, for I have no other proofe but at my owne charges, and my abilitie is able to doe nothing to make any proofe in thoſe cauſes. The third great cauſe is this, I I do know few Gunners, yea none at all in reſpect, that hath any capacitie, to know the diſtance unto any marke aſſigned, if that the marke be ſuch that they cannot come unto it directly by land, and yet there be very true and exact wayes to know the diſtance unto any marke aſſigned, howſoever the thing is, if that it may be ſeen by Geometrie perſpective: and the lacke therof amongſt Gunners is the principalleſt point that doth deceive them, ſo that theſe three things do utterly deceive moſt men: the firſt is this, the height or lownes of the ground: the ſecond the length of the peece: and the third not knowing the diſtance unto the marke: for their reaſon in theſe cauſes that they doe ſuppoſe, can doe nothing, that is to ſay, to finde the diſtance unto any marke aſſigned, by looking upon the ground, and that never can ſhew unto them the diſtance unto the marke, but yet muſt be knowen either by the Scale or croſſe ſtaffe, or elſe it muſt be knowen by the lines of Poſition, which is ſhewed in a booke of mine that is extant in Print, called the Treaſure for Travelers, and alſo in a booke ſet forth by maſter *Thomas Digges* called *Pantometria*, wherein thoſe two bookes you ſhall finde meanes and waies both how to finde the true diſtance unto the marke, & alſo how much that the marke is higher ground or lower ground, then the place that you are upon, and alſo the length of the line Hipothenuſall, whether it be up the hill or down the hill, which is very neceſſarie and profitable for all them that will uſe to ſhoote in great Ordnance, for to know, as all Gunners, Captaines, and Leaders of men, &c. And now friendly Reader, it is poſſible that ſome people will diſlike of me, for that I have written this Booke: ſome of them for that they doe thinke, that they have better knowledge in thoſe matters then I, and other ſome perhaps may be offended, for that they would not

have

have the thing known but amongſt themſelves, and otherſome poſſible will be offended with me that are Gunners, that are altogether without any knowledge in thoſe cauſes, that would not have their ignorance knowen. So by theſe meanes I am aſſured that I ſhal purchaſe a great number of enemies, as I do know that I have already cauſed ſundry people to envie me, as ſome Sea men do miſlike of me for writing of my booke called the Regiment for the Sea, and otherſome of late are offended with me for the writing and ſetting forth of my booke called the Treaſure for Trauellers, but notwithſtanding, I do ſee that it is needful to be known unto a number of them that be Gunners, waying and conſidering with my ſelfe what a number there be, that will take upon them to be Gunners, yea & that maſter Gunners, that are not ſufficient nor capable in thoſe cauſes, but are in reſpect altogether ignorant, ſtanding upon no other thing but their antiquitie, that they have ſerved as Gunners ſo long time. Wherfore I do think it very neceſſary for them to have ſome good inſtructions: but as far as I can ſee, every man maketh curteſie to do the common-wealth of our Realme of England any good therin, and as far as I can perceive that no people may better pleaſure the common wealth in the time of ſervice, either by Sea or Land, then may good Gunners againſt the face of our enemies: for the Realme of England hath a great number of enemies: for as we have ſeene by daily experience, that the Queenes progenitours aforetime were never long without wars, yet we have a moſt gracious & loving Prince raigning over vs, which doth alwaies ſtudy for peace & tranquillity: God grant of his mercy that he may live long and raigne over us. Amen. Yet notwithſtanding, it is good for us to ſtudy in the time of peace, how to defend our ſelves in the time of wars & troubles, as generally we provide in harveſt for to live in the winter. And for that cauſe have I written this little treatiſe, not to the intent to teach them that be cunning, but to give inſtructions unto them that be of the ſimpleſt ſort, &c. Wherfore (Gentle Reader) beare with my rudenes, for that I am ſo bold to be the firſt Engliſh man that put forth any booke as touching theſe cauſes, and it is poſſible that there be a number would looke that I ſhould have given them place, for that they are more worthy & skilfuller in theſe cauſes, thinking that I am to ſimple, for they doe not conſider how that God doth give his giftes, as we ſee daily, he giveth unto one man riches, and another man poverty, & one man to be a ruler, and an other to be inferior, one man wiſe & prudent, and an other ignorant, one man beautifull, and an other deformed, one man of a tall ſtature, & an other of a low ſtature, one man ſtrong and luſty, and another weake & lame: although that they be of one conſanguinity, linity or kindred, ſuch is the marueilous works of God. Wherfore menare not to be meaſured by elles, but by vertue, for God is not partiall in his gifts, for he hath ſhed his moſt precious blood for the redemption of all mankind, ſo that afore him all are one, for we are all his creatures and the ſheep of his paſture, and the workes of his hands, ſo he is our God, & we are his people, ſo that we keep his holy will and commandements but fleſh & blood is ſo fraile, that we can do no good of our ſelves, for God worketh the will and deed in all his creatures, for by his holy ſpirit he doth give ſundry gifts and all for the profit both of our ſoules & bodies, as Saint Paul ſaith to the Corinthians, To one is given through the ſpirit, the utterance of wiſedome, to another the utterance of knowledge by that ſame ſpirit, to another faith, by that ſame ſpirit, to another the gift of healing, by that ſame ſpirit, to another profeſſing, to another judgement to diſcerne ſpirits,

to another divers tongues, to another the interpretations of tongues, and all those doth the spirit of God work, and distribute unto every man according unto his most holy will and pleasure. Then what a vaine generation of people be wee to strive against the will and pleasure of God, as who should say, that God is bound to be ruled by the wil & pleasure of man. But what speciall gift soever God doth give unto man, let them give him thankes therfore, and looke that they do not abuse the same gift, for if that they do, it wil be a snare to take them in, and so be an example unto the whole world. For as soone as our heart is lifted up with vanities, then entreth the Devil & he causeth a man to fall & decline from God, thinking with our selves, that the gift that God hath given unto us commeth of our selves. For as some do think that have riches, that they have it by their own industry, and some doing divers other things, think that it commeth of themselves, with divers other speciall gifts that God giveth unto man, therfore whensoever God doth give any special gift to any person then let him give him thanks therfore, using it to the lawd, praise, glory, and honor of God, & to the profit of his neighbour, & the common wealth of his Native country, for great is the wickednes of the people upon the face of the earth, as considering this in these our dayes, that the Bishop of Rome with all his adherents, doth daily practise, how & by what meanes, to bring this our noble realme of England to utter confusion, therfore it is very meete and necessarie for us to devise how to prevent them, and then there is no doubt, if that we do our good will and indevour, but the living God will deliver us from the hands & snares of such wicked Antichrists, that do seeke the blood of the Christian servants of God. Wherefore it is very meet for us that be faithful Christians, & true subjects to our Prince & Country, to arme our selves; first with faith, secondly with manly courage, & thirdly with armor for our back, for let us be assured without Gods mightie providence unto the contrarie, that as soone as they have us at any aduantage, that then let us look for no other matter, but that they wil give the attempt, for such is the wickednesof the malicious Papists, yea even some of them are those that should or ought to be good subjects unto their Prince and native countrie. Wherfore I beseech the living God to confound such wicked Impes that should seeke the destruction of their Prince, and especially a vertuous, mercifull, and a godly Prince, and secondly the destruction of their native Realme & country, yea even the nurce to them and their forefathers, that hath yeelded unto them all kind of foode & necessaries. What greater wickednes can there be in men? & they themselves are bound by the laws of God, & also by the laws of nature, to defend their Prince and Countrie: for we nor they have no just quarell to fight by the lawes of God, but onely to defend our Prince, and country, and the liberties therof. Therfore it is meet for us to call unto God for mercie and grace, and then there is no doubt but that he will deliver us, & turne all their wicked devises unto their own destruction, even as them that make a pit for other and fall into it themselves. Wherfore it is meet for all them that are Noble men, and Magistrates, & such as are in authority, to cherish and maintaine all those that are good and vertuous subjectes, and good members in the common wealth, and contrariwise, it is very necessary and convenient to punish all wicked doers, and such as do annoy and hurt the common wealth, having no regard, neither for love nor favour, not hatred or malice, neither for bribes nor friends, but to reward every man according unto their deserts: for as it is sin to suffervice unpunished so in like manner it is as evil to see Vertue not rewarded, cherished nor maintained.

in ſhooting of Ordnance.

Tenne principall things are to be conſidered in the ſhooting of Ordnance, to keepe the length of the marke, or to make a perfit ſhotte at any marke aſſigned, according vnto the diſtance of the marke, and knowing what ſuch a peece will doe at ſuch an advantage in mounting.

1. The goodneſſe or badneſſe of the pouder.

THe good pouder driueth the ſhot further than the marke, the bad pouder ſhooteth ſhort of the marke: therefore you muſt vſe diſcretion in lading of the peece, according vnto the pouder.

2. The lading of peece.

IF you doe giue the peece more than her dutie, you doe ouerſhoote the marke: if you do giue her leſſe than her duty, you ſhoote ſhort of the marke: you muſt therefore giue the peece her dutie and no more.

3. The winde, and eſpecially to be mounted at much advantage.

THe winde with you, cauſeth you to ouerſhoote the marke, according vnto the hardneſſe. The winde againſt you, maketh you ſhoot ſhort of the marke, according vnto the hardneſſe. The winde one the ſide, the peece calleth beſide the marke: therefore you muſt weather the marke, according vnto the hardneſſe of the winde, and the diſtance vnto the marke.

4. Of the ſhotte.

THe ſhotte too bigge or too high, it putteth the peece in daunger: for you muſt driue the wadde and ſhotte home vnto the pouder in the peece, for if the ſhotte doe reſt any thing ſhort, it will breake the peece (or elſe it is a chaunce) in the vacant place betweene the pouder and the ſhotte. The ſhotte too low or ſmall, it will be too ſhorte of the marke, and alſo it will not doe his execution according vnto the peece and the pouder, and it may chance to ſwarue in the deliuerance out of the peece, therefore the ſhot muſt be fit for the peece.

5. Of the wadde, or the pouder rammed in too hard or too looſe.

THe pouder rammed in too hard, and the wadde alſo, and eſpecially the pouder being badde, or els not dryе, it will be long before the peece goe off, and alſo halfe the force of the pouder will be decayed, before the ſhot be deliuered, for that it bloweth out of the tutchhole, and alſo the peece will tremble before ſhee go off, and that may cauſe the ſhot to flee awryе from the marke, for that the peece is remoued from her leuell: and alſo it will beate the peece, and make the peece dangerous to ſhoote in preſently afterwards.

The pouder too looſe, and not well put vp with the rammer head, and alſo the wadde too ſlacke in like manner, will make the ſhot to come ſhort of the marke by the meanes of the looſeneſſe: you muſt therefore put vp the pouder with the rammer head ſomewhat cloſe, and the wadde to goe cloſe in, and driue it home vnto the pouder, but beate it not in too hard.

6. Of the standing of the peece

THe peece standing so that it may or doth recoyle vnto the lower ground, that is to say, that the ground be lower at the tayle of the peece, than it is where the wheeles stand, it ouershooteth the marke, for that in the deliuerance of the shot, the breech goeth downewards, and the mouth vpwardes, and the peece is apte to recoyle downe the hill: and if that the ground be higher behind the peece then it is before the peece, then it may happen to shoote short: but that is but a chance, for that is not so apte to recoyle against a hill, as it will do downe the hill.

And if it doth happen so, that the one wheele doth recoyle faster than the other wheele, then the peece will shoote awrye from the marke, or if any thing doe let or stay the wheele, it may shoote awrye, for the deliuerance of the shot causeth the recoyle of the peece, which is nothing else, but the suddain thrusting or the putting out of the ayre which is in the mouth of the peece.

7. Of shooting towards a hill or valley with a Quadrant

IF you shoote towardes a hill, you shoote short in the giuing leuell with a Quadrant. If you shoote towards a valley, you do ouershoot the marke, as in the thirteenth Chapter you shall see the reason therof. If vpon a leuell ground, you shall keepe the length of the marke by the degrees of the Quadran, otherwise not.

8. If you giue leuell with an ynche rule, you shall shoote at no certaynetie, but in such a peece as you do know well, for that it doth varie according vnto the length of the peece: as for example this, if you haue three Culuerings, the one is the ordinarie length, that is, twelue foote long: the other is more then the ordinarie length by two foote, that is, foureteene foote long: and the third is shorter then the ordinarie length by two foote, that is, but ten foote long: now if you do shoot at any mark, and do know the distance vnto the mark, and also do know, that a Culuering mounted at so many ynches vantage, will reach the mark, & admit that it wil reach the marke at twelue ynches vantage, now in the shorter peece, it ouershooteth the mark & in the longer peece it shooteth short of the marke, & in that peece that hath the ordinary length, you shall keepe the length of the marke: and the cause thereof is this: In the peece that is but ten foot long, the twelue ynches vantage commeth neere vnto fiue degrees with the Quadrante in the mounting: and in the peece of twelue foote long, the twelue inches commeth not to fiue degrees in the mounting with the Quadrant, and in the peece of foureteene foot long, it commeth but vnto foure degrees in the mounting with the Quadrant, as in the eight Chapter you may plainely see.

9. It is to be considered what disparte your peece most haue, if you doe giue leuell with an ynche rule at any aduantage, & also, if you do shoot at any marke within the right line or poynt plancke, as in the fourth Chapter it is shewed.

10. You must consider whether the peece be truely bored, as it is declared how you shall know it in the second Chapter: and how to shoote with a peece that is not truely bored, you shall see by the eleuenth Chapter.

The

¶ The Arte of ſhooting in great Ordnance.

CHAP. I.

How to know the goodneſſe or badneſſe of Powder.

Irſt concerning Powder, for that it is the chiefeſt matter as touching the ſhooting in Ordnance. According to ſome Authours, the firſt deuice of the making thereof began in Germany, by a Monke named Bertholdus Schwartus, neere about the yeere of our Lord. 1380. and ſince that time it hath bin put in practiſe from time to time, and from age to age, both by the learned Mathematicians, and alſo by the beſt Machaniſians, beſides a number of other common people, as well by them that haue bin ſeruetours, in martiall affayres, as all other, ſo that of the making of the peter, and alſo of the pouder, hath bin made great proffe vnto the vttermoſt, as touching the force of pouder, ſo that it is not vnknowne now in theſe dayes, what quantitie of euery ſeuerall ſortes of receiptes doth make the ſtrongeſt ſortes of pouder, beſides the perfit refining of the ſalt peter, and alſo the thorow working of the receiptes in the making of the pouder, ſo that it is now come to paſſe in theſe dayes, that the making of the pouder, and alſo the making of the ſalt peter, is become (in reſpect) a common thing amongſt a number of people, as it is made commonly in many partes in Germaine by the Boures or husbandmen, and alſo by the women: wherefore it were but ſuperfluous to ſay any thing therein, conſidering how well the making thereof is knowen vnto a number of people, and therefore the principalleſt thing in the ſhooting of Ordinance, is to know the goodneſſe or the badneſſe of the pouder, and that is knowen after the common order, that is, by three kinde of meanes, firſt by the taſting of the tongue, knowing by the ſharpneſſe thereof, whether that there be ſufficient of the maſter or peter or not: and ſecondly it is knowen by the couloure, for the good pouder hath ſomewhat a bleiwiſh couloure, and if it be Serpentine pouder, then the pouder will be as fine as ſand, and as ſoft as floure, and that ſignifyeth, that it is well wrought, and otherwiſe it will be harſh in your hand, and clammiſh, and looke with a darkiſh blacke couloure, and that ſignifyeth that it is well wrought, and the maſter not refined: and the third and principall is knowen by the burning, for if it be verie good pouder, then in the burning, the fire will be gone in the twinckling of an eye at a verie ſuddaine, and will giue a ſnap or ſuddaine puffe, and nothing remaining afterward, but a white ſmoke on that place whereas it was burned: but bad pouder in the burning fireth not ſo quickly, but fireth as doth a fire worke, very ſlowly, making ſome hiſſing, and after the burning, there will remaine certaine burreles or knottes that will conſume vnto moyſture, and be dankiſhe, and that ſignifieth: that the peter or maſter was not wel refined, neither the pouder wel wrought:

And after the burning of some kind of pouder, there will remaine certaine white burrles, or knottes (as before is rehearsed) that will remaine hard, and not consume after the burning, and that signifieth, that the pouder doth lacke of the matter or peter. And also here is one principall thing to be noted, that when pouder is drye, then the force of it in respect, is as it were double, or a quarter stronger, than when it is moist and dankishe, whether the pouder be good or bad. And also that pouder that is very good and well made, yet may happen to become moist, as many times by carriage too and fro in rainy weather, and also by laying it in some moist places, the caske being not very close and tight, that the pouder may grow dankish.

And also those kinde of pouders that the peter or matter is not well refined, but left full of salte, although that the pouder be neuer so drye when it is layd vp, yet it will giue againe in rainy wheather, and become moist, how drye soeuer the place be that it is layd vp in. Wherefore there are a number of things to be considered in pouder, as touching the shooting in great Ordinance, in a number of causes: for men of reason may know by the burning, coulour, talking and the handling of pouder, which is good, and which is bad: but to say iustly how much the one sort of pouder is stronger or weaker than another sort of pouder is, that is hard to know, although hee be the maker of the pouder, and hath wayed out perticularly the receiptes of the pouder: and the meanes thereof commeth to passe, as this, by the working thereof, and by the meanes of the drying thereof, and by the moistning or giuing of it againe, and especially if the pouder haue bin long made: so that it is a hard matter if a man haue of sundry sortes of pouder, to say iustly that thus much in weyght of this sorte of pouder, wil do as much, that is to say, to be equal in force, as so much in weight of that sorte of pouder, vntill that it be put in proofe in the shooting it in Ordnance. And thus I doe cease to write any more at this time of Powder.

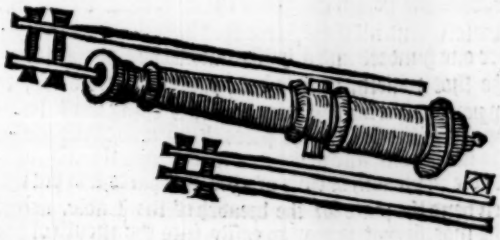
CHAP. II.

To know whether any peece of Ordnance be truly bored, by the help of certaine instruments

TO know whether that any peece of Ordnance be truly bored, there be diuers waies Geometrically for it to be done, but some of them bee too tedious, therefore for an easie way, they must make this kinde of instrument of two peeces of smal timber, or two right staues, that must beas long as the hollow or concauity of the peece, which must be made in this forme, and the staues must be made so fast at the one end, that it be not wider asunder at the one end, than it is at the other end, and so made fast, that they swarue not either wider or narrower: and then putting one of the staues into the mouth of the peece, and so measuring, or trying the peece round about with the staffe that is without the peece, with an yncke rule, you shall know whether that the core or hollownesse of the peece do run right in the middle of the mettle, and if it do not, you shall see how much the mettle, is thicker on the one side, then it is on the other. And also it is very good for you when you do meane to trie the peece,

to

to prepare a rammer head that is made fit for the peece, and to put it vpon the ſtaffe that you doe put into the peece, and to be made faſt vnto the ſide of the ſtaffe, and ſide of the rammer head, in ſuch ſort, that it may keepe the ſtaffe cloſe vnto the lid of the peece, the which it wil do the better, if the rammer head be to low, and then to haue a peece of a Sheepes skinne made faſt, or nayled vnto the contrarie ſide of the rammer head, and ſo it will keepe the long ſtaffe cloſe vnto the ſide of the peece, as by theſe two figures following you may perceiue.



And furthermore, they may make this kinde of inſtrument following, of yron, or any other ſtuffe meete for the purpoſe, for to gripe the peece in euery place at your pleaſure.

This inſtrument muſt bee double the length of the hollow or concauitie of the peece, and then you muſt put one of the right ones into the mouth of the peece, and then griping the inſtrument together, then that part that is without the peece, ſhall ſhew you how many ynches and partes of an ynch the mettall is of thicknes, without any fayle: and then trying the peece round about in euery place, the truth of the thicknes of the mettall ſhall appeare.

CHAP. III.

How much Pouder will ſerue any peece of Ordnance, by the weight of the peece, and weight of the ſhot: and at the end of this Chapter, there is a Table that doth declare the weight of Iron ſhot.

IF I know how much pouder will ſerue any peece of Ordnance, there be two ſpeciall points to be obſerued, that is to ſay, the weight of the ſhot of yron, & the weight of the mettall of the peece: & this is a generall rule, the peece hauing a reaſonable length, that is to ſay, that according vnto the accuſtomable

manner, according vnto the names of the peece or peeces all those peeces that haue 200. weight of mettall, or vpwardes, vnto one pound weight of shot, must haue as much Serpentine pouder as the shot waieth. And all those peeces that haue three hundred weight in mettal, vnto one pound weight of shot, do require as much Serpentine pouder as the shot wayeth, and one ninth part more. And all those peeces that haue vnder two hundred weight of mettall, and more than one hundred and a halfe, may haue as much Serpentine pouder as the shot weieth, lacking one ninth part. And all those peeces that haue 100. and a halfe of mettall, or thereabout, vnto one pound weight of the shot, must lack $\frac{1}{9}$ parts of pouder that the shot waieth. And all those peeces that haue but little more than one hundred, and vnder one hundred and a halfe, must lacke $\frac{2}{9}$ parts of the waight of the pouder that the shot waieth, that is but $\frac{7}{9}$ parts. Wherefore for the making of Ladles for any peece or peeces of Ordnance, this thing must be noted. First, take the compasse of the shot for the peece that you do make the Ladle for, and then diuide, or put the compasse of the shot into 5. equall parts, and then cut the plate of the Ladle in breadth of three of those fiue parts, and put the other $\frac{2}{5}$ parts away, and then bend the plate for the breadth of the Ladle, according vnto the compasse of the shot, so that it may go easily into the mouth of the peece: for $\frac{3}{5}$ parts is for to hold the pouder, to the intent to put it into the peece, & the $\frac{2}{5}$ parts be put away, to be open to turne the pouder into the peece. And now further more, for the length of the plate of the ladle, here is one thing to be noted, that euery 9 balles or shot being laid close together, & the plat being bent, & cut off, that breadth before rehearsed, & the plate in length to be cut off, that number of ynches that the nine shots doth reach, & that plate being equally filled with Serpentine pouder, will hold the full weight in pouder that the shot weyeth. Therfore for the length of the plate of the Ladle, thus you must vse it as followeth. For to make a Ladle for a double Canon, and the peece weying generally more or lesse. 7000. or 8000. & the shot weying within little more or lesse. 64. pound, that is, but little more then 100 of mettall, vnto one pound weyght of the shot, therefore this peece may lack $\frac{1}{9}$ part of the weyght in pouder that the shot weyeth: therfore they must cut the plate of the Ladle but 3. times the length of the shot, in ynches and parts of ynches, and this Ladle twice equally filled, shall be the dutie of the peece. Then for to make a Ladle for a Demy Canon, as the peece in mettall weyeth generally more or lesse. 5000. or 5700. and the shot weyeth more or lesse. 34. pound, which is about an hundred and a halfe of mettall, vnto one pound weight of the shot, therefore you must cut the plate of the Ladle three shots or balles and a halfe high, or 4. shots or balles high. In ynches and partes of ynches, according vnto the fortifying of the peece with the mettall, and the Ladle twice equally filled, to be the dutie of the peece. And for to make a Ladle for a double Culuering, those peeces being double fortified with mettall, and the peece waying generally more or lesse, foure thousand, or fiue thousand eight hundred, and the shot waying more or lesse 17. pounds, that is, about three hundred weight of mettall, vnto one pound weight of shot. Therfore you must cut the plate of the Ladle in length about the height of fiue shot or balles

balles, in ynches and partes: this Ladle being twice equally filled, ſhall be the dutie of the peece. And in likemanner the demy Culuering, and Falcons, and Falckonets, be double fortifyed with metall: therefore you muſt make their Ladle in length fiue ſhots or balles, in ynches or parts, and that Ladle twice equally filled, ſhall be the dutie of the peece. And furthermore, ſome Sakars and Minions haue but two hundred weight of mettall vnto one pound weight of the ſhot: therefore youmuſt cut the plate of the Ladle in length but of foure ſhots or balles and a halfe high: and that Ladle twice equally filled, ſhall be the dutie of the peece. And furthermore, now of late yeares, they haue deuiſed a more ſtronger ſorte of pouder, and not without good cauſe why, for the baſe pouder is not ſo good, if that it ſhould come vnto ſeruice, as corne pouder, or any other pouder is, that hath receipt ynough, and well wrought: for the baſe pouder doth beate and ſtreine the peece more than the good pouder doth: for if it be rammed on hard then becauſe it is not ſo quicke in the fiering, it lyeth and bloweth in the breech of the peece, before it can take fire, ſo by that meanes it heateth and ſtreineth the peece, and halfe of the force of the pouder is gone before the ſhot be deliuered: and then they muſt vſe batement for to ſaue the peece. Now whereas they ſhote good pouder, or corne pouder, they take much leſſe pouder, and and it ſendeth the ſhot quicker away, & it doth not beate the peece ſo faſt: for this we do ſee by common experience, that a little heat by long continuance, doth heat more, than a great haete by little continuance. And furthermore, in the ſhooting of good pouder, they ſhall not ſhew themſelues ſo often vnto their enemies. And eſpecially, the pouder would be put in cartredges, for in mine opinion it is a great deale better, for to charge a peece in time of ſernice with a Cartredge, than with a Ladle, for diuers conſiderations, as I do more at large declare in the ſixth Chapter. And furthermore, for to charge a peece with corne pouder, or any other good pouder, for the moſt part therof, two pound will go as farre as three pound of Serpentine pouder. As for example: that double Culuering that requireth eighteene pound of Serpentine pouder, twelue pound of reaſonable corne pouder will ſerue, according to the goodnes of the making of the pouder. And furthermore, vpon good conſiderations, for diuers cauſes, and eſpecially, for the Kings Nauie, they haue deuiſed to make their Ordnance ſhorter than the accuſtomed manner, and ſo by that meanes they are lighter than the peeces before time made, and yet as ſeruiceable as the longer in ſome points, ſhooting that weight in pouder, and that ſhot that the heauier doth, in all poyntes as the other: for that mettall that is taken from the length of the peece, hurteth not the fortifiyng of the peece. And as for the making of the Cartredges for any peece, it is eaſie enough to be done: for the compaſſe of the ſhot, and the length of the Ladle ſhall rule thatmatter well enough. Now ſhall follow a rule to know the weight of the yron ſhot, by theheight of the ſhot.

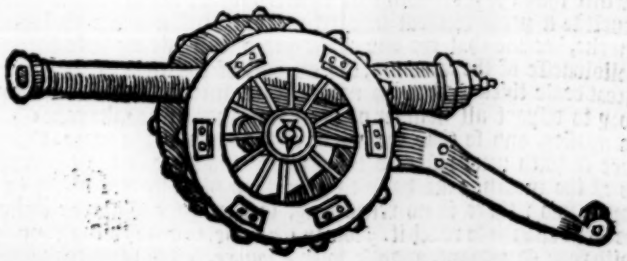
A Table to know the weight of *yron ſhotte.*

A Shot of 2. ynches high, doth wey. 1. *lb.* 1. ounce ¾.
A ſhot of. 2. ynches ¼ high, doth wey. 1. *lb.* 9. ounces. ⅝.
A ſhot of 2. ynches ½. high, doth wey. 2. *lb.* 2. ounces.
A ſhot. 2. inches. 3. quar. high, doth wey. 2. *lb.* 14. ounces.
A ſhot 3. inches high, doth wey. 3. *lb.* 12. ounces.
A ſhot. 3. ynches a quar. high, doth wey. 4. *lb.* 12. ounces.
A ſhot. 3. inches ½. high, doth wey. 6. *lb.* lacke. 1. ounce.
A ſhot. 3. ynches. 3. quar. high, doth wey. 7. *lb.* 5. ounces.
A ſhot. 4. ynches high, doth wey. 8. *lb.* 15. ounces.
A ſhot. 4. ynches a quar. high, doth wey. 10. *lb.* 10 ounces.
A ſhot. 4 ynches ½. high, doth wey. 12. *lb.* 10. ounces.
A ſhot. 4. ynches. 3. qua. high, doth wey. 14. *lb.* 14 ounces.
A ſhot. 5. ynches high, doth wey. 17. *lb.* 5. ounces.
A ſhot. 5. ynches a quar. high, doth wey. 20 *lb.* 1. ounce.
A ſhot. 5. ynches ½. high, doth wey. 23. *lb.* 2. ounces.
A ſhot. 5. ynches. 3. quar. high, doth wey. 26. *lb.* 6. ounces.
A ſhot. 6. ynches high, doth wey. 30. pound.
A ſhot. 6. ynches a quarter high, doth wey. 34. pound.
A ſhot. 6. ynches ½. high, doth wey. 38. pound.
A ſhot. 6. ynches three quar. high, doth wey. 42. pound.
A ſhot. 7. ynches high, doth wey. 48. pound.
A ſhot. 7. ynches a quarter high, doth wey. 53. pound.
A ſhot. 7. ynches ½. high, doth wey. 58. pound.
A ſhot. 7. ynches three quarters high, doth wey. 64. *lb.*
A ſhot. 8. ynches high, doth wey. 71. *lb.*
A ſhot. 8. ynches a quarter high, doth wey. 78. pound.
A ſhot. 9. ynches high, doth wey. 101. pound.
A ſhot. 10. ynches high, doth wey 138. pound.
A ſhot. 11. ynches high, doth wey. 184. pound.
A ſhot. 12. ynches high, doth wey. 240. pound.
A ſhot. 13. ynches high, doth wey. 305.
A ſhot. 14. ynches high, doth wey. 380. pound.

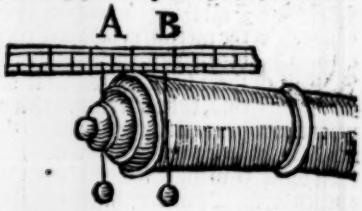
CHAP. IIII.

To diſpart any peece of Ordnance truely.

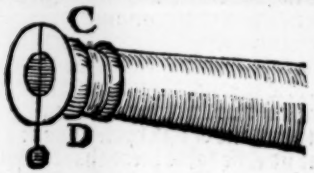
OF all things belonging vnto a Gunner, the chiefeſt is, to bring the mettall of his peece euen, for elſe he ſhall neuer ſhoote juſt to his mark, which Gunners call diſparting of their peeces: and there be many wayes to do it. Now to diſparte your peece, doe this, take a ſtring, ſuch a one as will not ſtretch, then gird your peece about her taile or great end in the very biggeſt place of the peece, then meaſure the line juſtly how many ynches the peece, was in the compaſſe, & then looke how many .22. ynches there be in the compaſſe, take ſo many .7. ynches for the Diametre, hight or thicknes of the circle, for in all circles being perfect round, as timber, ſtone, or any other mettall, look how many .22. ynches there be in the circumference or cõpaſſe, ſo many times .7. there is in the Diametre or height, then the height or thicknes of the breech of the peece being known, looke how many ynches & parts of an ynch it commeth vnto, then lay that vnto the mouth of the peece, and looke how much of that doth remaine ouer, then take halfe of that for your diſpart. But ſome do vſe to gird them (as afore is ſaid) and do put that into three equall parts, but that is not the exacte way, although it doth go ſomewhat neere the matter. Some alſo will take a priming yron, and put it into the tutchhole, and then lay it vnto the mouth of the peece, & looke what it commeth vnto more than the meaſure, they will take that for their diſpart: but that may deceiue them, as it is generally falſe. Wherefore this is a very good way, to take your rule of two foot long, and then lay that croſſe the tayle of the peece then take a plummet of lead vpon a line or a ſtring. Firſt hold the plumb line on the one ſid cloſe to the peece, that the line touch the peece without any bending then on the other ſid, as circumſpectly as you can, that the plummet line touch the ſid of the peece, without any bending, & then lay that meaſure to the mouth of the peece, & looke what the ouermeaſure commeth vnto, take halfe of that for your true diſpart. Now for your better inſtructions by this figure.



Firſt, I lay my rule of two foote long vpon the tayle of the peece croſſe A and B and then I hold my plummet of leade firſt vpon the ſaid A as you may ſee, and then hold my hand vpon the other ſide B cloſe to the ſide of the peece, then I doe looke how many ynches the tayle of the peece was from A & B, and I finde it ninteene ynches and a halfe: then I lay my rule unto the mouth of the peece C and D, and finde that the mouth of the peece is fifteene ynches



ſo there remaineth foure ynches and a halfe: then I deuide the foure ynches and a halfe into two equall parts, and that is two ynches and $\frac{1}{4}$ which I take for my diſpart: then with my plummet of leade, I goe vnto the mouth of the peece, and making a perpendicular line, and ſo I find the vppermoſt part of the peece: then I take a ſtraw, ſetting that perfitely vpright, according to the diſpart, two inches and a a quarter aboue the mouth of the peece, and make it faſt with a little ware, at the letter C, then bringing the taile of the peece to the toppe of the ſtraw which is my diſpart, leuel with my marke, there is no doubt, but I ſhall make a perfit ſhot, ſo that it be as far as within the caſt of the right line: for the diſparting of your peece, is but to bring



the mouth of your peece before, to be as high as the tayle behinde. For this you muſt conſider, that he that can by arte lay the hollow of the peece right againſt the marke, muſt needes hit it, ſo that it be not farther than the peece doth caſt vpon the right line, for he that ſhall giue leuell to a peece without diſparting, ſhall ſhot a great deale ouer the marke, becauſe that the ſide of the peece is contrary vnto the core or hollownelle of the ſame: for the mettall of the tayle of the peece, is a great deale thicker than the mouth. And furthermore, this a very good way to diſpart all manner of peeces of Ordnance: take your Calapar compaſſes, and ſo take the height of the tayle of the peece, then meaſure it with your rule and looke what it is more at the tayle, than it is at the mouth, take halfe that for your diſpart, and doing (as before is ſaid) there is no truer way, ſo that your Calapar compaſſes be large enough to reach it. Now in like caſe, you may diſpart your peece with your Quadrant, and alſo with a ſquare, but to teach tedious wayes

as

as long as a man may teach eaſilie, it were but ſuperfluous, and the eaſie wayes as good or better than the other.

Now as concerning chambred peeces, for the diſparting of them, there can be no perfect writting, for it muſt be conſidered and handled, according vnto the forme of the Chamber, and faſhion of the hall of the peece, whether it be Sling, Foller, Portepeece, or Baces: but any reaſonable man, (when he doth ſee the peece and the Chamber) may eaſily know what he muſt doe, as touching thoſe matters.

CHAP. 5.

How to give levell with any peece of Ordnance, to make a ſhot, as the moſt ſortes of Gunners vſe to doe although there be no Arte in it.

FOr the making of a ſhot, that is to ſay, to giue leuel vnto any marke aſſigned, with a peece of Ordnance, without the right line, according vnto the accuſtomable manner that Gunners vſe, for that they doe not know the diſtance vnto the marke, and therefore doe but giue a geſſe what aduantage will reach the marke, and if that it be with an ynch rule, then thus they doe.

Firſt, by their judgmentes they doe giue that ſo many ynches aduantage as they ſuppoſe will reach the marke, and then by the firſt lighting or falling of the ſhot, hee doth ſee whether it be ſhort or gone ouer the marke, and if it be ſhort, then at the nert ſhooting hee will giue the peece more aduantage by the ynch rule: and if it be ouer, then he will giue the peece leſſe aduantage with the ynch rule: and ſo by diuers times ſhooting off the peece at a marke, they will finde how many ynches and parts will keepe the length of the marke. And if they do not ſhoote with an ynch rule, then they will giue the peece the aduantage by ſome aſſigned place beyond the marke that they doe ſhoote at: and if the ſhot do light ſhorter, then they will giue the peece more aduantage at the nert ſhot: and if the ſhot be farther then the marke, then they will giue the peece leſſe aduantage at the nert ſhot. And ſo by often ſhooting at the marke, they will hit the length of the ſame, and then knowing at what marke the peece muſt be mounted vnto, right ouer the marke, then they alwayes mount the peece vnto that aduantage, and they ſhall alwayes keepe the length of the marke, with that peece at that marke, the peece to be laden alwayes equally with Pouder.

But by this order of ſhooting, he ſhall neuer become cunning, although hee ſhot a thouſand ſhots, for that there is no methode or order in the doing thereof, but only with that peece at the marke: for if you do ſhoote with another peece at that marke, although the peece doth ſhoote that ſhot, and that weight in Pouder, the peece may ſhoote vnder or ouer by the meanes of the

length.

length of the ſame, or the bigneſſe or ſmalneſſe of the breech, and the mouth of the peece in mettall. And to bring that peece vnto any other place, they muſt do as at the firſt, to proue what will reach the marke: and therefore this kind of ſhooting is to no purpoſe, but only in a Towne or Caſtell, in the time of ſeruice, for him that hath the charge of Ordnance, to proue what the peece will doe at euery marke, as touching the keeping of the length of the marke, whereby they may the better ſhoote at their enemies when they doe ſerue, otherwiſe it will be to no great purpoſe: for as often as you do alter or change your peece, or take that peece away to ſerue in an other place, ſo oft you are to ſeeke, and to proue the thing new againe, whether you doo vſe to ſhot with the ynch rule, or by the degrees in the Quadrant: for if you doe ſhoote with the ynch rule, then the length of the peece will alter it, as is ſhewed in the 8. chapter following. And if you ſhoote by the degrees in the Quadrant, then the highneſſe or lowneſſe of the ground ſhall cauſe them to erre, as I doe ſhew in the thirteenth Chapter. Wherefore, if I were worthy to giue counſell, I could ſhew them how to vſe the matter, that they might attaine to know the length of the marke at the firſt ſhot, but I neuer ſaw it ſo handled, whereby they ſhould attaine it: for all the proſes that haue beene made as yet by Engliſhmen, are no proſe, but altogether to cauſe them that did ſee the proſe, to commit further errour, as touching the diſtance vnto the marke, or hitting the length of the marke.

CHAP. 6.

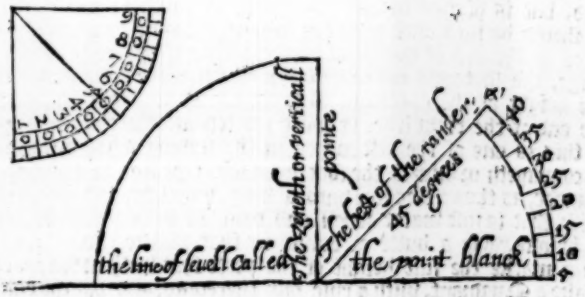
What a degree is, &c.

FVrthermore, whereas this booke is named The Arte of ſhooting in great Ordnance, ſo in like manner I thinke it conuenient, to ſhew you what the word Arte meaneth, or ſignifieth, which is, the deſcribing of a way or methode, how to attaine to the certaintie of any matter. Which as hitherunto I haue not ſeene any ſuch booke, although it hath beene very neere two hundred yeeres ſince the firſt inuention of Ordnance: and except there be any better booke in ſome mens hands, ſuch as I haue not ſeene, as it is like enough that there may be, there is no Arte in any of them: yet I haue ſeen a number of bookes that haue beene written concerning Ordnance, but ſurely they that wrote them, were not ſeene in any part of the Mathematicall ſcience, neither good Machaniſians, but (in reſpect) vtterly voyd of any ſcience: (in compariſon) no good order deſcribed in the ſhooting of Ordnance, to know what diſtance the ſhot is deliuered from the peece: neither haue they knowen what inſtruments haue meaned. And although they haue named degrees in their bookes, yet it appeareth vnto me that they haue not knowledge what a degree ſignifieth, for that they haue named a Quadrant, a Triangle, and other fond and fooliſh by-names. Wherefore they that haue written

those

thoſe bookes that the Gunners haue amongſt them, were vtterly vnlearned in any manner of ſecine, which were in the beginning, in the time of King Henry the eight, made by Flemmings: for in the warres in thoſe dates the King ſent ouer into Flaunders, and thoſe parts thereabout to haue Gunners to ſerue him in the warres, and the Gunners haue no other bookes, but ſuch as were written by them: wherefore I doe thinke it good to ſhew vnto you what a degrée is.

A degrée is a part or deuiſion of a whole circle into 360. equall parts, as the ancient fathers aforetime haue taught, and eſpecially in Aſtronomy. And it is very profitable for Gunners to know the vſe of them. The Quadrant that they doe occupie, is the fourth part of a circle, deuided into 90. equall parts, according vnto the fourth part of the Heauens, for the Zeneth or pricke in the Heauens (ouer the Crowne of your head, downe to the Horizon) is deuided into 90 equall parts, according vnto the Quadrant. As for example: If there were a perpendicular line let downe out of the Heauens vnto the earth, then ſhould the earth be a right line, and make a ſquare angle vnto the furtheſt part of the Horizon that you can ſée, and ſo paſſe vnto the Heauens, as doth the Quadrant: and then the beſt of the Rander is 45. of theſe deuiſions, called degrées (as ſome mens opinion hath béene) and that is halfe 90. and the ſaid 45. degrées be the beſt of the Rander in ſome caſes, and that is with the winde, but otherwiſe, it is not, as it is further declared in the 5. Chapter. And for better example, I haue placed this figure.



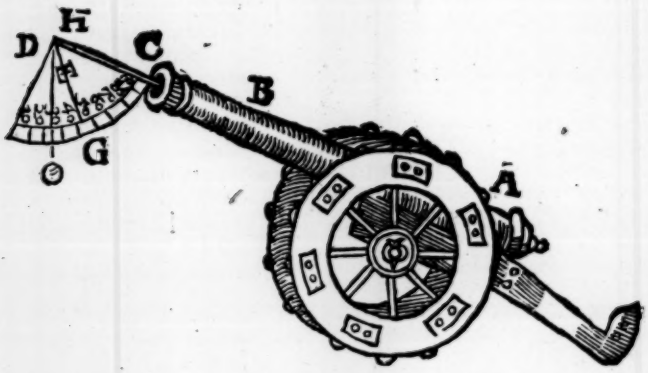
CHAP. 7.

How to make a ſhot vpon the right line, and alſo to know how much ground any peece of Ordnance doth drive or convey the ſhot at the mount of every degree of the Rander.

FVrthermore, any peece of Ordnance being truly diſparted, as is declared in the fourth Chapter, they may know at all times how for to ſhoot juſt vnto the marke, eſpecially within point blanke, and point blanke, is the direct flæing of the ſhot, without any deſcending from the mouth of the peece vnto the marke, the mouth of the peece to ſtand directly with the Horizon, ſo that it be vpon a plaine and leuell ground, as farre as the peece may caſt, hitting any thing that ſtandeth directly as high as the mouth of the peece, laying the hollow or concauitie of the peace againſt the thing that you doe ſhoot at, &c. And to ſhoote at any marke vpon the right line, you ſhall doe it by this meanes: your peece being truely diſparted, and the diſpart ſet vpon the mouth of the peece, bring the middle of the taple of the peece to the top of your diſparte vpon the mouth of the peece, and the marke that you doe ſhoote at, all three vpon one right line, by the ſight of one of your eyes, and then foreſeeing that the peece ſtandeth vpon a leuell ground, and the one wheele to bee as nimble as the other, this done, there is no doubt but you may ſhoot as neere the marke with a Cannon as with a Bargabus, or Caliuer. This is moſt certaine. Therefore it is very neceſſary to know how farre any peece will conuey the ſhot vpon the right line, and that is ſomewhat hard to doe, for there is ſeldome any ground, but is higher in one place than in another, and then if the peece ſhould be layd cloſe vnto the ground, it would graze before that it were at the end of the right line, and then if the peece be in her carriage, the ſhot will not graze before that it were deſcended, as much as the height of the carriage. And for to ſet vp any thing certaine at the end of the right line, it were too tedious, therefore in my opinion, this is one of the beſt wayes, in the finding what diſtance any peece conueyeth or driueth the ſhot vpon the right line or any degree of the Rander, as thus: Repaire vnto a very leuell ground, as a plaine marriſh, that is juſt water leuell, and then to finde the right line or point blanke, rayſe a butte or banke in that plaine ground, and then ſet vp a marke the juſt height of the peece that lyeth in the carriage, and take a Quadrant, with a rule faſt thereunto, and put the rule into the mouth of the peece, and coyne the breech of the peece vp and down, vntill the plumet hang at the corner of the Quadrant, and then ſhall the Concauitie of the peece lye right with the Horizon, neyther higher nor lower: then ſhoot off the peece againſt the But: if the ſhot be

vnder

vnder the marke: it is more then the right line, then you muſt bring the peece neerer vnto the butte, banke or marke: but if it be the juſt height of the mark, then remoue the peece farther off from the marke, and ſo remouing the peece forwards and backwardes, you ſhall finde the true right line of the peece. By this order, you may try the true right line of all manner of peeces of Ordnance. And whereas the opinion of diuers Gunners is, the one contrarie vnto the other, ſome holding an opinion, that the longer peece doth ouerſhoote the ſhorter, and ſome that the ſhort doth ouerſhoot the longer: the troth is, that the longer peece doth ſhoot further than the ſhorter, although that in the mounting of a long peece & a ſhort with an ynch rule, the ſhort peece doth ouerſhoote the longer, although both ſhoote one ſhot, and one ſort and weight of pouder, as you may perceiue in the nert Chapter following, and alſo in the beginning of the Booke in the eight conſideration. &c. Furthermore, to know what any peece of Ordnance will doe at the mounte of euery degree, and what diſtance of ground the ſhot doth fly, do this, the ground being plaine & leuell (as before is rehearſed) place the peece in this manner: you muſt make a hole in the ground, to the intent to make a platforme, to ſet the peece vpon, in ſuch order, that the tronchions of the peece being in her carriage, be juſt in heigth leuell with the ground, neither higher nor lower: then take your Quadrant, and the rule faſtned thereto, and put the rule into the mouth of the peece, and ſo mount the peece vnto one degree, ſhooting off the ſame, and ſeeing the firſt graze, meaſure the diſtance of ground, and note or marke that: then in like manner mount the peece vnto two degrees, and ſo vnto three degrees, and ſo forth from degree to degree, vntill the peece be mounted vnto the beſt compaſſe of the Rander. Thus ſhall you know what any peece will doe at the mount of euery degree. &c. But if you ſhould make your proofe vpon ſuch ground as is not leuell, then your proofe ſhould be erronious, for that the Quadrant ſheweth by the degree, how much it is higher than the horizon, for if the ſhot doe not finde ground in his deſcending, equall with the heigth of the peece, the ſhot fleeth further that it ſhould doe. And alſo if the ground be higher than the place than the peece doth ſtand vpon, then the ſhot will be ſtayde the ſooner, by the meanes of the heigth of the ground, as I doe more at large declare in the. 13. Chapter following. And for your better inſtruction of the mounting of the peece, I haue made this figure following.



Firſt take the Quadrant, and put the rule of the Quadrante E into the mouth of the peece C, and then putting vp or downe the tayle of the peece A, till the plummet G fall vpon the corner of the Quadrant at D, then looke whatſoeuer you ſée right with the vpper ſide of the Quadrant H, ſhall be leuell with the mouth of the peece, and that is called the poynt blancke, for that vpon a leuell ground without any hills, as vpon the ſea, that all things ſtandeth ſo leuell, ſhall be right with the Horizon, that is to ſay, at the parting of the earth and the Skye, by the ſight of your eye: and then putting downe the tayle of the peece A, the plummet line G will hange at what degrée you pleaſe towards the middle line of the Quadrant E, then the mouth of the peece B and C will goe vpwards, &c. Now ſhall follow (according vnto the proſe that I haue made, but yet not to my contentation, neither in reſpect to no purpoſe) the argument of the proportion of the mounting of euery degrée vnto the beſt of the Rander, according vnto the proſe that I haue made. Looke how much ground the peece conueieth the ſhot from the right line, vnto the mounting of fiue degrées, that is as much ground as the right line, and two ninth parts more, and from the mounting of fiue degrées vnto ten degrées the ſhot is conueyed as much ground as the right line, and $\frac{2}{9}$ part more, and from the mounting of ten degrées vnto fifténe degrées, the ſhot is conueyed as much ground as the right line iuſt. And from the mounting of fifténe degrées vnto the mounting of twenty degrées, the ſhot is conueyed halfe as much ground as the right line iuſt: and from the mounting of any peece from twenty degrées vnto the beſt of the Rander, the ſhot is conueyed in all about $\frac{2}{3}$ parts of the right line, and

that

that is in a faire calme day, and then two and foztie degrées is the beſt of the Rander, and with the winde fiue and foztie is the beſt of the Rander, and againſt the winde, as the winde is in bigneſſe, that is, one and foztie, oz foztie, oz nine and thirty, oz eight and thirtie, oz ſeuen and thirty, oz ſixe and thirty degrees, the winde being altogether the ruler thereof. Therefoze it is but a folly to make accoumpt thereof, neither is there any ſeruice aboue the mounting of any péece of Ordnance, aboue 20. degrees, excepte it be a moꝛter peece, and the ſhot is conueyed off ground from the mouth of the peece vnto the lighting oz falling of the ſhot, to the beſt compaſſe of the Rander, about fiue times and a halfe as much ground as the right line, being (as befoze is declared) within a little vnder oz ouer, accoꝛding as the winde bloweth moze oz leſſe, againſt the winde, oz with the winde, and ſo foztly. But here is one principall thing to be conſidered and that is this, that you doe alwayes charge the peece with juſt one weight, and one ſoꝛt and kinde of pouder, foꝛ other waies, in the doing thereof, you may commit erreur, as befoze is declared in the firſt Chapter. As touching the knowing the goodneſſe of Pouder, foꝛ that it chanceth many times that they haue not always one ſoꝛt of Pouder, neither alwayes of one mans making, but of ſundꝛy mens making, and ſo by that meanes, ſome Pouder is better than ſome is: therefoze it is a hard matter foꝛ to know certainely, that thus much in weight of this pouder, is equall vnto the foꝛce of ſo much in weight of that ſoꝛt of Pouder: wherefoze in mine opinion, that engine oz little bore that is deuiſed to proue the foꝛce of the Pouder is very neceſſarie to be vſed, foꝛ by it you may juſtly know which ſoꝛt of Pouder is ſtronger oz weaker in foꝛce than the other, by waying alike ſome ſmall quantitie of each ſoꝛt, and ſo putting the pouder into the engine oz bore, and burning it, firſt the one ſoꝛt, and then the other ſoꝛt, and looke which ſoꝛt of Pouder doth blow, oz lift the lid of the bore higheſt, that is the ſtronger ſoꝛt of pouder, and you ſhall know by how much, by the teeth oz notches that doe ſtay the lid of the engine oz bore, and ſo by that engine oz bore, you may fit the foꝛce of the pouder, that is to ſay, if that you doe occupy ſo much pouder with any peece of Ordnance. And foꝛ that you would keepe that length of the marke at ſuch an aduantage in mounting, if you haue no moze of that ſoꝛt of pouder, but that the pouder that you haue is either ſtronger oz weaker, then doe thus: wey out ſome ſmall quantitie, as the weight of a grote oz ſix pence, moze oz leſſe at your diſcretion, as the engine oz bore is, and firſt burne that ſoꝛt of pouder in the bore that you doe know the foꝛce of it alreadie, and then looke vnto what teeth oz notch that the lid of the engine oz bore is lifted vp vnto, and then wey out of the other ſoꝛt of pouder the like weight, and ſo burne that in the bore oz engine, and if it doth blow oz lift the lid hygher than it was befoze, then it is a ſtronger ſoꝛt of pouder, if not ſo high, then it is a weaker ſoꝛt of pouder: and

by the number of notches, you shall know how much. Therefore if it be a larger sort of Pouder than that you have occupied already, then weigh out a lesser weight of the same, and burne that in the bore or engine, and so doing, both by the waighing and burning of it in the engine or bore, untill that it lift or blow the lid of the engine, unto the just height that it was with the first sort of Pouder: but if the first sort of Pouder did blow or lift the lid higher than the other, then wey out more in weight than the first, and so by the weighing and burning of it in the engine, untill the lid be lifted unto the just height that it was before, so by that meanes you shall know fully how much weight of one sort of Pouder shall be equall with the force of that sort of Pouder, and so by this meanes although you change the sorts of your Pouder, never so often, yet you may so fit the peece by the weight of your Pouder, that the peece of Ordnance shall keep one length at the mark. Having this consideration, both in the lading and the wadding, to bee in such order, that is to say, to keepe a methode in the doing thereof, neither to put in the pouder too hard, neither too loose, neither the wadde to go in too loose, neither to be too much too much hard, but reasonable. And as touching the fashion and the making of the engine or bore, I do omit that in this booke, for that I doe shew it in my Booke, called The Inventions or devices, in the 54. Deuice.

CHAP. 8.

How for to mount any peece of Ordnance by the degree with an Inch rule, with a Table, shewing what part of an inch rule will make one degree, and so unto tenne degrees.

FOR the making of a perfect shott at any degree of the Rander, and to have a good length at the marke, the distance of ground being knowen, first it behoueth him for to know the force of his pouder, which is shewed in the Chapter going before, and to have his Pouder put in Cartredges, either of Paper or Cannas, and the Pouder weied that the one Cartredge be not heavier than the other, according unto the Peece, and the goodnes of the Pouder: for there can be no certainty when that the peece is laden or charged, sometime with more Pouder, and sometime with lesse: and especially in the time of service I do see that there is no worse lading or charging of Ordnance, than with a Ladle, whether it be by Sea or by land, for by the lading with a Ladle, it must be twice filled, and then at euery time that the Pouder is put into

into the peece, it muſt be put up with the Rammer head, ſo that they muſt either turne the other end of the Ladle, or elſe if that the Rammer head bee upon the ſponge ſtaffe, then he muſt change the ſtaues, which is a great number to doe in a narrow roome. And alſo in the charging of a peece with a Ladle, he cannot fill it ſo equally, but that the Ladle ſhall haue ſometime more pouder, and ſometime leſſe Pouder by a good quantity, and eſpecially if that he doth it haſtily as in the time of ſeruice it alwaies requireth haſte, and that may cauſe him that giueth leuell, to ſhoot vnder or ouer the marke, or too ſhort, or too farre, although that he hath found what aduantage will reach the marke.

And alſo it is vnprofitable and dangerous to lade or charge a peece with a Ladle, for that the Pouder is apt to be ſhed or ſpilled being haſtily done, and then it is apt to be fired, conſidering what a dangerous point it is for the burning and ſpoyling of men.

Wherefore if your Pouder bee in Cartredges, and alſo weyed, the peece is more ſoner and eaſilier laden or charged, and hee ſhall keepe the length of the marke the better, and alſo you may keepe the Pouder the cloſer and better, and not ſo apt to be ſhed or ſpilled, for when that the Cartredges bee filled, then they may bee ſet upright in ſome Tubbe or Barrell, and then they may take out one by one as need ſhall require, and ſo couer the barrell cloſe againe, that it may be without danger.

And now for the giving of leuell with any peece of Ordnance, and the marke more than the peece can reach upon the right line, and the diſtance knowen unto the marke, and alſo you knowing what ground the peece will conuey the ſhot vpon the right line, then by the order in the Chapter going before, you may know how many degrees will reach the marke. And for that it is ſomewhat tedious and difficult to mount any peece of Ordnance with a Quadrant, except it be upon a plaine and leuell ground, that the peece ſtandeth no more, but the iuſt height, or the lowneſs of the marke, which happeneth very ſeldome. Therefore I do thinke it very good to ſhew you how to mount any peece of Ordnance by the degree, with an inch rule, according to the length of the peece, and to know how many inches, and parts of an inch will make or giue one degree unto ten degrees. Hereafter is a Table, the length of the peece ſtandeth in the margent towards the left hand, and the ſquare right againſt, that is the mount of one degree, and the vppermoſt number in every ſquare, is the inches, and the vndermoſt numbers is the odde parts of an inch, and the Table beginneth at the length of the peece fiue foot and a halfe, and ſo encreaſeth by the halfe foote, till the peece be full fifteen foote long.

This

¶ This Table doth shew what part of an ynch rule will make one degree, and so vnto tenne degrees:

	Degrees. 1	2	3	4	5	6	7	8	9	10	
	1	2	3	4	5	6	7	9	10	11	Inches
Foote 5. ½ long.	1/22	2/11	2/22	4/11	11/22	2/11	11/22	1/11	4/22	4/11	Partes.
Foote. 6. long.	1	2	3	5	6	7	8	10	11	12	Inches.
	1/4	1/2	3/4		1/4	1/2	3/4		3/4	1/2	Partes.
Foote. 6. ½ long.	1	2	4	5	6	8	9	10	12	13	Inches.
	4/11	8/11	1/11	5/11	9/11	2/11	6/11	10/11	3/11	7/11	Partes.
Foote. 7. long.	1	2	4	5	7	8	10	11	13	14	Inches.
	5/11	1/11	6/11	9/11	3/11	8/11	2/11	7/11	1/11	6/11	Partes.
Foote. 7. ½ long.	1	3	4	6	7	9	10	12	13	15	Inches.
	6/11	1/11	7/11	2/11	8/11	3/11	9/11	4/11	10/11	5/11	Partes.
Foote. 8. long.	1	3	5	6	8	10	11	13	15	16	Inches.
	15/22	4/11	5/22	8/11	2/22	1/11	12/22	5/11	1/22	9/11	Partes.
Foote. 8. ½ long.	1	3	5	7	8	10	12	14	15	17	Inches.
	12/22	6/11	1/22	1/11	12/22	7/11	2/22	3/11	21/22	11	Partes.
Foote. 9. long.	1	3	5	7	9	11	13	15	17	19	Inches.
	10/11	9/11	8/11	7/11	6/11	5/11	4/11	3/11	2/11	1/11	Partes.
Foote. 9. ½ long.	2	4	6	8	10	12	14	16	18	20	Inches.

Foote 10. long.	2	4	6	8	10	12	14	16	18	20	Inches.
	1/11	2/11	2/11	4/11	5/11	6/11	7/11	9/11	9/11	10/11	Partes.
Foote 10 ½ long.	2	4	6	8	10	13	15	17	19	21	Inches.
	2/11	4/11	6/11	8/11	10/11	1/11	2/11	5/11	7/11	9/11	Partes.
Foote. 11 long.	2	4	6	9	11	13	15	18	20	22	Inches.
	1/11	6/11	9/11	1/11	4/11	7/11	10/11	1/11	5/11	8/11	Partes.
Foote. 11 ½ long.	2	4	7	9	12	14	16	19	21	24	Inches.
	2/22	9/11	5/22	7/11	1/22	5/11	19/22	1/11	15/22	1/11	Partes.
12	2	5	7	10	12	15	17	20	22	25	Inches
	1/2		1/2		1/2		1/2		1/2		Partes.
Foote. 12. ½ long.	2	5	7	10	13	15	18	21	23	26	Inches.
	2/11	3/11	10/11	6/11	2/11	9/11	5/11	1/11	8/11	4/11	Partes.
Foote. 13 long.	2	5	8	10	13	16	19	21	24	27	Inches.
	8/11	1/11	2/11	10/11	7/11	4/11	1/11	9/11	6/11	3/11	Partes.
Foote. 13. ½ long.	2	5	8	11	14	16	19	22	25	28	Inches.
	9/11	7/11	5/11	3/11	1/11	10/11	8/11	6/11	4/11	2/11	Partes.
Foote. 14. long.	2	5	8	11	14	17	20	23	26	29	Inches.
	10/11	9/11	8/11	7/11	6/11	5/11	4/11	3/11	2/11	1/11	Partes.
Foote. 14. ½ long.	3	6	9	12	15	18	21	24	27	30	Inches.
	1/22	3/11	5/22	2/11	7/22	1/11	9/22	5/11	11/22	6/11	Partes.
Foote. 15. long.	3	6	9	12	15	18	21	24	28	31	Inches.
	2/22	3/11	5/22	6/11	7/22	4/11	9/22	10/11	11/22	1/11	Partes.

Then first repaire unto the order of the Chapter that goeth before, and consider by the distance that the peece conueyeth the shott upon the right line, and looke how much the shot may be conueyed at the mount of one degree, and so from degree to degree, till you have the length in degrees, that the shot may reach the marke, and then repaire unto the peece, and measure how many foot long the peece is, then according to the length of the peece, there is a Table in this Chapter going before, in the Margent of the which, towards the left hand, that number is the length of the peece, then right against that number in the first square, it doth shew how many inches, and parts of an inch will make one degree: and the next square will shew you how many inches, and parts of an inch will make two degrees, and so forth unto the number of ten degrees, and no more: and the cause is this, for that there is commonly no service to be done, above the mounting of any peece of Ordnance more then ten degrees, neither the inch rule will serve any further, for that the degrees be taken out of the circumference of a circle, and not out of a right line. And now to use the matter in the handling of the rule to make a perfit shot, doe this: prepare your rule, and let it bee well divided, into inches, halfe inches, and quarters of inches, and halfe quarters of inches, and then let there be a slit in the middle of the rule, and in the slitte let there be made in brasse or latine a sight, that it may be moued vp and downe at your pleasure, and then the rule is finished. Now when you would make a shot at any marke, lette the peece be truly disparted, and the dispart set upon the mouth of the peece, or else, if the dispart be not set upon the mouth of the peece, yet you must know perfectly the Dispart of the peece, and to make account what number of inches it is, and to reckon that as part of the mounting of the peece by the degrees. Now the distance of ground being known unto the marke, and also to know how many inches, and parts of an inch will make the number of degrees, the account of the dispart being made, or else the dispart being set upon the mouth of the peece, then set the rule upon the breech of the same perfectly upright, in such order, as the toppe of the rule bee not nearer unto the mouth, than that place of the breech of the peece that the rule doth stand upon, whether the peece haue much aduantage, or little, so that the toppe of the rule must not hang backwards or forwards, but alwaies at one proportion from the mouth of the peece: that being done, turn the peece right unto the marke, and then coyne the breech of the peece vp and downe, untill the middle of the mouth of the peece, or else the top of the disparte, and the marke be seene through the sight in the slit of the rule, just at the number of inches, and parts of an inch, that will answer unto so many degrees, as the Table in this Chapter going before doth shew. This being done, the shot shall haue a good length at the marke. As

for

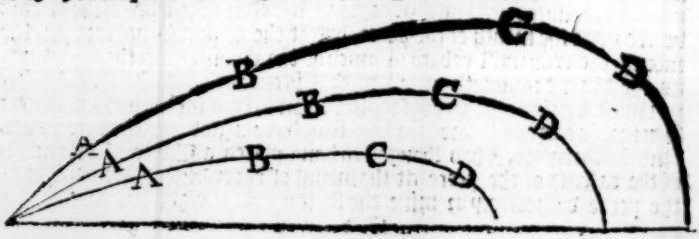
for example, suppose that I doe shoote in a Saker that conveyeth or driveth the shot upon the right line or point blancke, 26. score, and the marke that I doe shoot at is 40. score from the peece, then I have either made proofe by the order prescribed in the 7. Chapter that goeth before, or else I have the Tables of some other men, as Tartalia the Italian hath made Tables thereof. And so I do finde, that 2. degrees will reach the marke, then I do repaire unto the peece and measure it, how many foot long the peece is, and I doe find that the same is, 9. foote and a halfe in length from the mouth to the breech, then I repaire to the Table in this Chapter before, where I find that 2. inches doth make a degree iust, and now the peece must be mounted unto 2 degrees iust, and then twice 2. inches, maketh 4. inches then I doe dispart the mettall of the peece, as I doe shew you in the 4. Chapter, and so I doe find that the mettall of the breech of the peece is an inch and a halfe thicker at the breech, than it is at the mouth of the peece, and then I do set up a rush or a straw on the mouth of the peece, and so making it fast with a little ware iust one inch and a halfe above the mettall of the mouth of the peece, then I doe take the inch rule, and so I do remove the sight in the slitt of the rule unto iust 4. inches, and I doe set the rule perfitely upright upon the middle of the breech of the peece, and so remoove the peece too and fro, and coyne the taile of the peece up and downe, till such time as I may see the marke through the sight in the slit, and the top of the dispart, all three upon one right line, by the sight of mine eie, and the sight in the slitt, to stand at iust 4. inches, then shooting off the peece, you shall make a perfit shot. And furthermore, if the dispart bee not set upon the mouth of the peece, then you must make account therof, for that the peece doth mount himself an inch and a half, therfore you must give the peece but 2 inches and a half advantage, to reach the marke. And furthermore, I will giue you a second example in the same peece at a greater distance, at 80. score from the peece, and that is almost a mile, and then doing (as before is said) to seeke how many degrees will reach the marke, and I find that peece that driveth or conuaieth the shot 26. score upon the right line, that at 9. degrees it will convey or drive the shot 80. score, and (as before is shewed) that in that peece that is 9. foote and a halfe long 2. inches maketh iust one degree, and then the peece must be mounted unto iust 9. degrees, which is 18. inches, if the dispart be set upon the mouth of the peece, but if the dispart be not set upon the mouth, then you must rebate so much of the advantage in the mounting, as the dispart commeth unto, and that is one inch and a halfe. Therfore you must set the sight in the slit, but upon sixteen inches and a halfe, and so doing (as before is said) the shot shall have a good length at the mark. And furthermore, I had thought to have placed a Table of proportion of the casting of the peece at the mount of every degree, accordingly as the peece doth convey or drive the shott upon the right line, but that I

haue not made any ſuch exact proofe, neither am I of that ability, neither as farre as I can iudge, there is no man will be at any ſuch charge. But the cracteſt matter that I haue heard that Tartalia the Italian hath made perfit proofe thereof before diuers of the nobility of Italy, whereupon, he hath made Tables (by report) very exact, yet I could neuer come by the ſight of them, neither are they in his Booke that he hath made for theſe cauſes.

CHAP. 9.

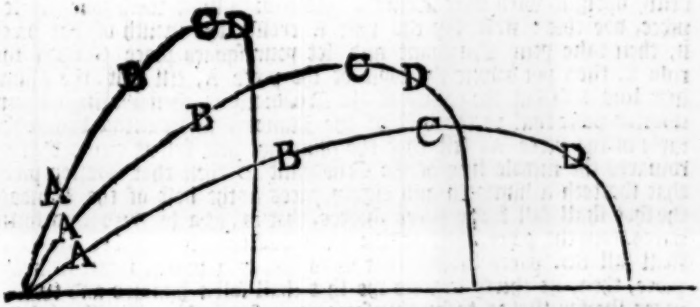
What manner of courſe the ſhot flyeth in the ayre.

AS I ſuppoſe, it is very neceſſary to know what manner of courſe or proportion the ſhot flyeth in the ayre in his compaſſe, that is to ſay, at any degree mounted that the peece is ſhot at the Rander. All thoſe peeces that be ſhot at the mounting of any degree aboue point blancke, and vnder the beſt of the Rander, hath 4. manner of courſes in his driuing or flying, by the violence of the blaſt of the powder, before the ſhot come to the ground, ſo that the peece be ſhot againſt a leuelled ground. The firſt courſe is by a right line, and ſo long as the ſhot goeth violently. And the ſecond courſe doth begin for to compaſſe, and yet flieth ſomewhat vpwards into the ayre, that is to ſay, further aboue the earth circularly. The third courſe is for a certaine ſpace or quantitie at the higheſt diſtance from the earth. And the fourth courſe is, it commeth downewards circularly towards the earth, and ſo ſtouping more and more, till it commeth downe to the ground: as for example this: If any peece that is ſhot at the beſt of the Rander, that is to ſay, at 45. degrees, and alſo at the mounting of thirtie degrees, and alſo at the mounting of fifteene degrees, and A ſignifieth the right line, and B the ſecond courſe in flying of the ſhot circularly vpwards, and C ſheweth the vppermoſt courſe or flying at the fartheſt diſtance from the earth, and D ſheweth the circular falling or comming downwards, or the ſtouping or falling more circularly, than any of the other courſes or falling of the ſhot, and the more neerer vnto the ground, the more circularly the compaſſe is made, as this figure doth ſhew.



Now

Now furthermore, if any peece be ſhot in the mounting of any degree, aboue. 45. degrees, then the ſhot ſhall haue a perpendicular line or fall, before that the ſhot ſhall come to the ground. Therefore I doe ſay, that the more that any peece is mounted aboue fiue and fortie degrees, by the meanes of the perpendicular or falling, that the ſhot falleth ſhorter and ſhorter at the mounting of euery degree: therefore they doe neuer mount any manner of peece aboue the compaſſe of 45. degrees, except it be a Mortar peece, and thoſe be mounted alwaies aboue. 45. degrees. for that the more the perpendicular line is, the more violently the ſhot commeth downe, and the more the peece is mounted, the higher into the ayre the ſhot flyeth, and then the more is the perpendicular line, and the neerer vnto the peece the ſhot falleth. Therfore that mortar peece that is ſhot aboue. 45. degrees, the ſhot hath. 5. manner of courſes, that is to ſay: firſt his right line vp into the ayre: ſecondly, his circular fleeing vp into the ayre: thirdly, his furtheſt diſtance from the earth: fourthly, his circular comming downewards: and fiftly, his direct fall or perpendicular line downe to the earth, as this figure may repreſent, the one line to be the beſt of the Rander, the other line to be the mounting of 15. degrees more than the beſt of the Rander: & the third, the mounting of. 30. degrees aboue the beſt of the Rander. And the cauſe that the ſhot hath his direct fall vnto the earth, is his



naturall courſe, for firſt it is driuen violently by the blaſt of the Powder vp into the ayre by a right line, and then ſecondly, as the violent drift doth decay, ſo it flyeth circularly, and thirdly, the force of the drift being all decayed, it muſt needes haue his naturall courſe, and all things that be of earthly ſubſtance, muſt needes returne to the earth againe.

CHAP. 10.

How to mount a Morter peece for to lay the shot at any distance appointed.

FOr the shoting of Morter peces, it is to be considered, that those peces must be mounted aboue the compasse of fiue and fortie degrees, for that these peces are vsed at the seege of Townes, for the annoyance of their enimies, that is to say, to the intent to beat downe their lodgings or houses, with diueres other purposes more. And to haue the shot to fall at any distance appointed, they must doe this: For euery degree that those peces be mounted, the shot falleth shorter, as in the Chapter before is declared, and till that the mouth of the pece doth stand directly on your perpendicular line, or Zeneth, or pricke, with the crowne of your head, and then the shot shal fal directly into the mouth of the pece again, except that the accedence of the wind doth put it beside the mouth of the pece, as this: first shoot this pece at the mount of fiue and fortie degrees, that is the best of the Rander, measure the ground from the mouth of the pece vnto the first falling of the shot and the measure being knowne, deuide that into fiue and forty equall parts, & euery one of these parts of measure, shall be the falling shorter of the shot, at the mounting of one degree. As for example, a Morter pece, that shooteth a. 180. paces at the best of the Rander, shall shoot at the mounting of euery degree foure paces shorter: and so from degree vnto degree, till that the mouth of the peces standeth directly vpright with your Zeneth. Now for to shoot with your Morter pece, doe this: first lay the rule E crosse the mouth of the pece B, then take your Quadrant and set your square place G vpon the rule E, then put downe the tayle of the pece A, till that the plummet line F fall at the corner of the Quadrant C, then shooting off your Morter pece that is the best of the Rander, and putting downe the tayle of the pece A, till that the plummet line fall at tenne degrees towards the middle line of the Quadrant D then that Morter pece that shooteth a hundreth and eighty paces at the best of the Rander, the shot shall fall fortie paces shorter, that is, at a hundred and fortie paces from the pece, then at the mount of twenty degrees, the shot shall fall 80. paces shorter, that is to say, at a hundred pace from the pece, then, at thirty degrees the shot shall fall a hundred and twenty paces shorter, that is to say, threescore paces from the pece, then at the mounting of forty degrees, the shot falleth at a hundred and threescore paces shorter, that is, at twentie paces from the pece. And thus it may be seene, that from the mounting of euery degree the shot falleth shorter foure paces. and thus, by deuiding the best of the Rander into fiue and fortie equall parts, you shall know the mount of euery degree, at what distance the shot shall fall from the pece, as by these figures following it doth appeare.

Chap.

CHAP. II.

How farre above the marke the ſhot flyeth over the marke by the length of the peece, and diſtance vnto the marke

FVrthermore, heere is one eſpeciall point to be noted, for a number of Sea Gunners doe not vſe for to diſpart their peece: and I do thinke that a great number of them cannot do it very well, for that cauſe they will ſay, that they neede not diſpart their Ordnance. But if they do not diſpart their great Ordnance, and eſpecially thoſe new peeces that be now adayes made for the Ships, they ſhall do but ſimple ſeruice, beſides the great charge in waſt that they ſhall put them to that beare the charge thereof: for one ſhot of the great Ordnance, is twenty times the charge of the ſmall peeces: and many of the ſmall peeces in a manner needeth no diſpart, but the great peeces: for the mettall of the tayle of the peece is a great deale bigger than the mouth of the peece. And this is generall for euer, looke how much that the mettall is thicker vpon the one ſide at the tayle of the

peece

peece than it is at the mouth of the peece, then look how many times that the length of the peece is vnto the marke, ſo many times the thicknes of the mettall is thicker at the breech of the peece, than it is at the mouth, ſo many times the quantity ſhall the ſhot flye ouer the marke, if ſo bee that the peece be ſhot without diſparting, and the marke within point blanke, or the right line of the peece: as for example thus, by a peece of Ordnaunce, that the mettall of the breech of the peece is thicker by three inches on the one ſide, than it is at the mouth of the peece, and the peece is juſt ten foot long, and the marke is juſt twenty ſkore from the peece. Now the peece being ten foote long, there is juſt fiue times the whole length of the peece in euery ſkore, for that a ſkore is fortie foot, and fiue times ten is fifty foot, then the mettall of the breech of the peece, being three inches thicker than it is at the mouth of the peece, the peece ſhall caſt ouer the marke at the end of euery ſkore eighteene inches, for that the peece ſhooteth three inches ouer the marke at euery time the length of the peece, and then fiue times three inches, maketh eighteen inches; ſo then it muſt needs be ſaid, that at the end of twenty ſkore, the peece muſt needs caſt twenty times eighteen inches, ouer the marke, and twenty times eighteen inches, maketh three hundred and fortie inches, and that containeth thirty foot, ſo that I doe conclude that the peece which is but ten foot long, and the mettall three inches thicker on the one ſide at the breech of the peece than it is at the mouth, and the marke twenty ſkore from the peece, this peece being ſhot without any diſparting, being ſhot againſt an upright wall, then bringing the middle of the mouth of the peece, and the middle of the taile of the peece, and the marke, all three upon one right line, and then the ſhot ſhall hit the wall iuſt thirty foot right ouer the marke, and this ſhall bee true without any faile. Then this being true, what mad men bee thoſe Gunners that will be of ſuch an opinion, that they need not to diſpart their Ordnaunce.

CHAP. 12.

How to make a perfect ſhot with a peece that is not truely bored, that is to ſay, that the core or hollownes goeth not right in the middle of the mettall.

So it chanceth many times through the negligence or default of Founders, that ſome peeces be not truly bored, that is to ſay, that the core or hollownes of the peece runneth not right in the middle of the mettall, but the core or concauity declineth or leaneth more unto the one ſide, than it doth on the other, for although at the mouth of the peece the mettall bee round about of one like thicknes, yet at the breech of the peece the mettall may be thicker on

one the one ſide, than it is on the other, and then that peece will neuer ſhoot right vpon the marke: and alſo this peece is very dangerous to ſhoot in for feare of breaking. And this is generally for euer. Looke at that ſide that the mettall is moſt thickeſt at the breech, from that ſideward the peece doth caſt, and then right againſt the thickeſt part of the peece, there is the thinneſt ſide of the mettall, ſo that the mettall be perfit round on the outſide of the peece, and alſo the hollow and concauity within the peece, and towards the thickeſt ſide of the mettall of the peece, towards that ſide the peece caſteth. And for to know how much, you may eaſily perceiue: looke how much the thickeſt ſide of the mettall is thicker than the thinner ſide, looke how many times the hollow of the peece is vnto the marke, ſo many times halfe the thickneſſe that the mettall is thicker on the one ſide, than it is on the other, ſo many times that proportion ſhall the ſhot ſtie wide of the mark, towards that ſide, that the mettle of the peece is moſt thickeſt. As for example this, there is a peece, that the mettall is thicker one the one ſide, than it is on the other ſide by two inches, and the core or hollowneſſe from the touch-hole vnto the mouth of the peece is 10. foot long, and the mark that the peece is ſhot at is 20. skore from the peece: now there is 6. times the length of the hollownes of the peece in euery skore, and the peece caſteth one inch awry at euery time the length of the hollow of the peece, for that the mettall is thicker on the one ſide, than it is on the other by 2. inches, then take from the thicker ſide one inch, and adde vnto the other ſide that one inch, then it will ſet the hollownes of the peece right in the middle of the mettall as it is 5. inches thick on the thicker ſide, and but 3 inches thicke on the thinner ſide, then take from 5. inches one inch, and there doth remain but 4. inches, and then adde vnto 3. inches one inch, and then it maketh 4. inches, and then both the ſides bee of one like thicknes: then (as before is ſaid) there is 6. times the length of the hollowneſſe of the peece in every skore, ſo that the peece caſteth awry in every skore 6. inches. Then it muſt needs be ſaid, that at the end of 20. skore, the peece caſteth beſides the mark 20. times. 6. inches, and it maketh 120, inches, and that is 10. foot iuſt. And furthermore, for to make a perfit ſhot with this kind of peece, it is a ſtrange matter vnto Gunners, and they had need to be very circumſpect for feare of ouercharging, for you muſt not giue this kind of peece pouder according vnto the weight of the mettall, for that ſhe hath too much mettall on the other ſide, where it doth no good. And now for to make a ſhot with this kind of peece, do this: firſt ſearch the peece with thoſe kind of inſtruments that I haue ſpoken of in the 2. Chapter, then if the thickeſt part of the mettall be vpon the vpper ſide of the peece, that is to ſay, at the touch-hole, the peece being as before is declared 2. inches thicker of mettall there, than it is on the lower ſide, when that you haue diſparted your peece truly, as though the hollownes of the peece

ran right in the middle of the mettall, ſet up your diſpart upon the mouth of the peece one inch the more, for that the mettall is thickeſt upon the upper ſide thereof by 2. inches, and halfe 2. inches, is one inch: then bringing the middle of the taile of the peece, and the top of your diſpart, and the marke, all three upon one right line, by the ſight of your eie, the peece being ſhot off you ſhall make a perfect ſhot upon the right line. Then if the thickeſt part of the mettall by two inches be under the peece, that is to ſay, that at the touch-hole, the mettall is at the thinneſt, when you doe ſet up your true diſpart upon the mouth of the peece, rebate one inch of the length of the diſpart, or elſe the peece will caſt the ſhot under the marke, for that the thickeſt ſide of the mettall is downewards. And furthermore, if that the thickeſt part of the mettall chanceth in any other place, howſoever that it chanceth, then at the thickeſt ſide of the peece make a little marke, as you may doe it with a little ware as big as a pinnes head upon the very breech of the peece: then when you have diſparted this peece truly as though the hollowneſſe of the peece did runne right in the middle of the mettall, ſet up your diſpart upon the ſide of the mouth of the peece, as right as you can make it, with a line againſt the little ware that is on the thickeſt ſide on the breech of the peece, and then make the diſpart one inch the more, for that it is the thicker ſide with mettall by two inches, and then bringing the top of the diſpart, and the little ware, and the marke, all three upon one right line, you ſhall make a perfit ſhot. And furthermore, if that it chance ſo, that the thicker ſide doth lye ſomewhat vnderneath the peece, then ſet vp your diſpart vpon the thinner ſide of the peece, and alſo the little ware vpon the breech of the peece, and then you muſt rebate one inch from your true diſpart, and this by conſideration, there can be no peece but that you may make a perfit ſhot, for he that can by Art lay the hollow or concauity of the peece againſt the marke, muſt needs hit the marke, ſo that the marke bee not farther off than the peece can reach upon the right line: and this is true without any faile.

CHAP. 13.

How to give levell at a marke upon a hill or valley, with the Quadrant.

FOR the ſhooting at a hill or valley to give levell with the Quadrant, there is two principall things to be conſidered, and eſpecially, if that the marke be further than the peece will reach upon the right line. Firſt, when they do know the diſtance unto the marke, and the marke more then that the peece will reach upon the right line, then mount the peece ſo many degrees, till that the peece be able to reach the marke, then take your Quadrant, and looke through the two ſight of the Quadrant, the plummet

plummet hanging at libertie, till you may ſee the marke juſtly vpon the hill, winking with one of your eyes, then looke vpon what degree and place the plummet line doth hang vpon, then mount the peece ſo many degrees more as that doth come vnto, for the height of the hill, then that being done you ſhall make a perfect ſhot: as for example this: by a marke that ſtood vpon the ſide of an hill, and by Geometrie perſpective, the diſtance is found to be ſixtie ſkore from the peece, and now the peece is a Culuering, ſuch a one as ſhooteth thirtie ſkore vpon the right line, or point blancke. Now the marke is thirty ſkore more then the peece can reach vpon the right line, therefore you muſt mount the peece, till it be able to reach the marke, and that is, at the mount of foure degrees, as it doth appeare by the cranning of the ſeuenth Chapter, and there you ſhall find it to appeare to be at the mount of foure degrees: now that being knowen, take your Quadrant, and take the number of degrees that the hill is in height, higher then the ground that you ſtand vpon, and that is done (as before is declared) and then you find that the marke is fiue degrees higher than the ground that your peece lyeth vpon, then adde that number vnto the other, and that maketh in all nine degrees juſt, for that the peece is mounted foure degrees for to reach the marke, and fiue degrees for the height of the marke, which is higher ground than that the peece doth lye vpon, then laying the peece right vpon the marke, there is no doubt but that you muſt needes make a perfit ſhot, and to lay the peece right vpon the marke, the peece being mounted (as before is ſaid) then take a plummet of leade vpon a ſmall line or ſtring, and let that be holden vp at the breech, at the very end of the peece, euen at the very middle of the taple of the peece, then ſtand directly behind the peece, and wind the peece, till you do ſee the middle of the mouth of the peece, and the marke, all three vpon one right line, by the ſight of your eye, winking with one of your eyes, and there is no doubt, but your peece doth lye right vpon your marks, and ſo forth. And now in like manner, if you doe make a ſhot towards a valley, and the marke more then the peece will reach vpon the right line, then knowing the diſtance vnto the marke, mounte the peece, vntill it be able to reach the marke, then turne your Quadrant, that the ſight go downewards, the plummet hanging at libertie, then you may ſee how many degrees the ground is lower, then the ground that the peece doth lye vpon, and rebate ſo many degrees as that number commeth vnto, and laying the peece right vpon the marke, there is no doubt but you ſhall make a perfit ſhot, as by an example, with that peece and at that diſtance before rehearſed, to a marke in a valley, the ground being lower at the marke you ſhot at by three degrees, then that ground that the peece doth lye vpon: now you muſt mount the peece foure de-

grees to reach the marke, and then you must rebate three of those degrees for the lowneſſe of the marke, and then you may conclude, that the peece being mounted but one degree, it doth shoot that distance that it did at nine degrees. And the reason thereof is most manifeſt, for that the one is vp the hill, and the other downe the hill. And furthermore, with that peece, and at that distance before spoken of, and also at that number of degrées downe the hill that the other was vp the hill, that was at five degrees, and now foure degrees will reach the marke vpon a plaine leuell ground, but for that it is downe the hill, you must rebate five degrees. Wherefore you may conclude, that the peece must be leuelled with the Quadrant, one degree vnder the poynt blancke, that is to say, lower then the Horizon by one degree, for that the deepeneſſe of the valley is the cauſe thereof. Wherefore in mine opinion, it is better for Gunners to vſe to giue leuell with an ynch rule, as I do afore declare in the eight Chapter, for I do know, that this is the cauſe that hath deceiued a great number that are meanly ſeene in thoſe matters, and for lacke of conſidering of thoſe cauſes that may happen or chance, hath diſcouraged many that would haue beene well ſeene in thoſe matters.

CHAP. 14.

How to make a perfect shot vpon the land, at the broad ſide of a Ship that is vnder ſayle, and going.

FVrthermore, for the making of a perfit ſhot vpon the land, at a ſhip that is vnder ſayle in a Riuer, the chiefeſt matter is, to haue good Powder, that the péce may goe off ſo ſoone as thée hath fire giuen vnto her: and to ſhoot at her broad ſide, doe this: Firſt before ſhe commeth to you, view at what proportion ſhe commeth, that is to ſay, whether that ſhe commeth in the middle, or vnto any of the ſides, or vnto any other proportion then your péces being truely diſparted, lay your péce, againſt ſome marke vpon the further ſide of the Riuer, that being done, then keyne vp the tayle of the péce, till the top of the diſpart ſtandeth with that proportion which the ſhip commeth vpon: that being done, then it is good for you to haue another imagined marke, ſomewhat nérer the Ship, beſides that marke which the péce lyeth vpon, like a twentie foot, according vnto the way of the Ship, for if that the Ship haue freely way, then giue fire vnto the péce or péces, twentie or thirty foote, before that the Ship commeth vnto your thwart marke that the péce lyeth right againſt, and this being diſcréetly done, there is no doubt but you ſhall make a perfect ſhot. And furthermore, if it be vpon the

Sea

Sea coaſt, where there is no land ſeene vpon the further ſide, then take a thwart marke by ſome Cloude that is alow neere the Horizon. And furthermore, if that any ſhip do go directly from you-wards, or elſe come directly to you-wards, then it is a ſmall matter to make a perfect ſhot, that is to ſay, if that her head or ſterne be towards your Ordnance. &c.

CHAP. 15.

How to make a ſhot out of one Ship vnto another, that although the Sea be wrought, or out of a Galley to a Ship.

AS for Gunners that doe ſerue by the Sea, muſt obſerue this order following. Firſt, that they doe foreſee that all their great Ordnance be faſt breached, and foreſee that all their geare be handſome and in a readineſſe. And furthermore that they be very circumſpect about their Pouder in the time of ſeruice, and eſpecially beware of their lintſtockes, and candels for feare of their Pouder, and their fire-works, and their Ducum, which is very dangerous, and much to bee feared. Then furthermore, that you do keepe your peeces as neere as you can, dry within, and alſo, that you keepe their touchholes cleane, without any kind of droſſe falling into them. And furthermore, it is good for the Gunners to view their peeces, and for to know their perfect diſpart, and marke it vpon the peece, or elſe in ſome Booke or Table, and name euery peece what it is, and where ſhe doth lye in the ſhip, and name how many inches, and halfe inches and quarters of inches the diſpart commeth vnto, and then in time of ſeruice, although that you haue no time to ſet vp your diſpart you may conſider of it, and doe it well enough. And furthermore, if that you were driuen to make a ſhot vpon a ſodaine, and know not what diſpart would ſerue the peece, yet this you may doe, and ſpeede well enough: firſt looke all alongſt by the ſide of the peece as neereas you may at the middle of the breech of the peece, vnto the middle of the mouth of the peece, and ſo by the ſight of your eye, lay it right againſt the marke, and then keepe vp the tayle of your peece faſt, for that giueth the peece the true height of the marke: then take the next ſight aloft vpon the peece, from the breech of the peece, vnto the mouth, ſo lay the peece right vpon the mark. But you would iudge by the ſight of your eye, that the peece lye a great deale, vnder the marke: for that the mettall of the peece is a great deale thicker then the mettall of the mouth the of peece, & therfore the ſight of the ſide of the peece, giueth her the true height of the marke, and then

laying the peece right with the Ship that you doe meane to shoot at, looking well to your Steerage. Now furthermore, if the Sea be wrought or growne, and the Ships doe both heaue and set, then if you would make a perfect shot, doe this: First chuse your peece betweene the Lanstan, and the maine Mast, vpon the lower Drop, if the Ship may keepe the port open, and for this cause you shall do it, for that the ship doth least labour there: for any Ship that doth heaue, and set neuer so sore, doth hang as though she were vpon an Arletree, there labouring least, except she doth seele or roule. But if any Ship hang any thing by the wind, it will not lightly seele or roule. Then if you doe make a shot at another Ship, you must be sure to haue a good helmesman, that can steere steadie, taking some marke of a Cloude that is aboue by the Horizon or by the shadow of the Sunne, or by your standing still, take some marke of the other Ship through some hole, or any such other like. Then he that giueth leuell, must obserue this: first consider what disparte his peece must haue, then lay the peece directly with that part of the Ship that he doth meane to shot at: then if the Ship be vnder the lee side of your Ship, shoot your peece in the comming downe of the Gayle, and the beginning of the other Ship to rise vpon the Sea, as neere as you can, for this cause, for when the other Ship is a lofe vpon the Sea, and shee vnder your Lee, the Gayle maketh her for to head, and then it is likest to do much good.

Now furthermore, if that the Ship you do shote at haue the weather gage of you, then your peece that you doe shote at her, must needes be on the weather side of the Ship: then giue fire vnto the peece in the righting of both the Ships. When that the Gayle is ouer, you must awaite when the other Ship doth begin for to arise vpon the Sea, & especially that part of the Ship that you do mean for to shot at, for this cause, for when that the Gayle is ouer, then both the Ships do right, for if that you should shot in the holding of your ship, then you should shot ouer the other Ship. And furthermore, if you shote when the other Ship is aloft on the top of the Sea, you haue a bigger marke than when she is in the trough of the Sea. Therefore there is no better time for to giue fire, then when shee is beginning to rise vpon the Sea, that is, when you see her in the trough of the Sea: and you must vse that according vnto the distance betweene two Ships, for you must consider, that the shot must haue a time for to come to the ship, for no man can describe the thing so well, as he that doth see the thing apparant before his eyes, for his reason in those causes must helpe him, and the principall thing is that, that he that is at the Helme must be sure to steere steady and bee ruled by him that giueth the leuell, and he that giueth fire, must be nimble, and ready at a suddaine. And also he that is at the Helme, must be nimble and steady, that is, to put roomer, when that

the

the other Ship doth put roome, and for to lofe, when that the other Ship doth ply his lofe. And it is good for the Gunner to kéepe the mouth of his péece fomewhat with the loweſt, rather then any thing with the higheſt, for if that the ſhot flyeth ouer the Ship, then it doth no good, but if that it commeth ſhort of the Ship, it will graze in the water and riſe againe, and ſpéede well enough, ſo that it be not too much too ſhort of the Ship, for too much too ſhort doth kill the ſhot in the Sea, and eſpecially if that the diſtance be any thing farre off. And furthermore, for the Sea fight, if the one doe meane to lay the other aboorde, then they doe call vp their company, either for to enter or to defend: and firſt, if that they doe meane for to enter (as you may know) that he will preaſe to lay you aboorde, then marke where that you doe ſée any Scottles for to come vp at, as they will ſtand nére there aboutes, to the intent for to be readie, for to come vp vnder the Scottles: there giue leuell with your Fowlers, or Slinges, or Baſes, for there you ſhall be ſure to do moſt good, then furthermore, if you do meane for to enter him, then giue leuel with your Fowlers and Portpéeces, where you doe ſée his chiefeſt fight of his ſhip is, and eſpecially be ſure to haue them charged, and to ſhoot them off at the firſt boording of the Ships, for then you ſhall be ſure to ſpéede. And furthermore, marke where his men haue moſt recourſe, there diſcharge your Fowlers and Baſes. And furthermore, for the annoyance of your enemie, if that at the boording that the Ships lye, therefore you may take away their ſtéerage with one of your great péeces that is to ſhoot at his Rother, and furthermore at his maine maſt, and ſo forth. Thus much haue I ſaid as touching Sea Gunners, for that I do know they do meddle with no other fightes, and therefore it is méete for him to ſéeke as much as in him lyeth, for to annoy the enemie with fire-workes and Ordnance, &c. And furthermore, if the Ship doth fœll or rowle, then the beſt place of the ſhip for to make a ſhot, is out of the head or ſterne. And furthermore, for to make a ſhot out of a Galley, and eſpecially the Cannon that lyeth in the Caſe, or Prow, he that giueth fire, muſt be ruled by him that is at the Helme, becauſe he can neither keepe her vp nor downe, for that ſhe lyeth in the caſe, for he that ſtireth, muſt giue leuell. And furthermore, the Cannon that lyeth in the caſe, cannot lightly ſhoot a ſhip vnder water, neither betweene the wind and the water, where that it is not on the Sea, and eſpecially if the Ship be at hand, for that ſhe lyeth leuell, for looke how high, that the péece is aboue the Sea, ſo high ſhall the ſhot hit any thing aboue the water, as farre as the péece can caſt vpon the right line. And for to make a ſhot out of a Galley vnto a Ship, for to ſtrike her vnder the water, or betweene the wind and the water. Firſt, waite the Ship lying in the trough of the Sea, when ſhe doth begin to riſe

vpon

vpon the Sea, and then in like manner, when you do see that the Galleys head doth begin to descend, then give fire vnto the peece, and you shall make a perfit shot. Furthermore, if the Galley be in fight with another Ship in a calme, then the Ship will skant wine or stir, and then the Galley may play off and on at her pleasure: and then to make a shot at hand, is some matter, for in a calme, the Ships doe neither rise nor fall, but a little, in comparison of any thing to the purpose: neither doth the Galleys head either heaue nor set to any purpose, if the Ship be at hand, to the intent or purpose to shoot a Ship vnder the water. Therfore when you meane to strike a Ship vnder the water with a Galley, and dare not lay them aboord, then kayle your Cabels forwards, with the trimming forward of your waighty geare into the Galleys head, so low, till it shall serue your turne, by bringing also your men forwards: then by the Stéerage with your Oares, or with your Helme, you may shoot against what part of the Ship you will, and so shoot her vnder water at your pleasure.

CHAP. 16.
In what order to place Ordnance in Ships.

AND furthermore, I do thinke it conuenient to shew you how to fit or place Ordnance in any Ship: and this is to be considered, first that the cariage be made in such sort, that the peece may lie right in the middle of the port, and that the trockes or wheeles be not too high, for if the trockes be too high, then it will keepe the cariage that it will not goe close vnto the Ships side, and by that meanes the peece will not scant go out of the porte, except that the peece be of some reasonable length: and also, if that the Ship do hold that way, the Trockes will alwayes runne close to the Ships sid, so that if you haue any occasion to make a shot, you shall not bring the Trockes off from the Ships sid, but that it will run too againe. And the wheele or Trocke being very high, it is not a small thing vnder a Trocke will stay it but that it may runne ouer it, &c.

And also, if that the Trocke, be hygh, it will cause the peece to haue the greater reuerse or recoyle, therefore the lower that the wheeles or Trockes be, it is the better, and so forth.

Alwayes prouided, that the peece be placed in the very middle of the porte, that is to say, that the peece lying leuell at poynt blancke, and the Ship, to be vpright, without any helding, that it be as many inches from the lower side of the porte beneath, as it is vnto the vpper part aboue iustly. And the deeper or hygher that the portes be vp and downe, it is the better to make a shot, for the helding of the Ship, whether that it be the

lee

lée ſide, or the weather ſide of the Ship, for if you haue any occaſion to ſhoot either forwards or backwards, the ſtærage of the Ship will ſerue the turne, but if that the ſhip doth hæld much, then if that the pæce be let by the lower part of the porte, then you muſt nædes ſhoot ouer the marke, and if it be let by the vpper ſide of the porte, then you ſhall ſhoot ſhort of the marke, &c. Wherefore, when that the Carpenters doth cut out any portes in a ſhip, then let them cut them out bæpe enough vp and downe, &c.

And alſo, it is very euill, for to haue the Vlloppe or Decke too low vnder the porte, for then the carriage muſt be made very high, and that is very euill in diuers reſpects, for then in the ſhooting off the pæce, it is apt to ouerthrow, and alſo by the labouring and the ſæling of the ſhip, and ſo forth.

And furthermore, you muſt haue a conſideration for the fitting of your Ordnance in the ſhips, as this, the ſhorter Ordnance is beſt to be placed out at the ſhips ſide, for two or three cauſes, as this.

Firſt, for the eaſe of the ſhip, for their ſhortneſſe they are the lighter: and alſo, if that the ſhips ſhould hæld with the bearing of a ſayle, that you muſt ſhut the portes, eſpecially if that the Ordnance be vpon the lower Vlloppe, and then the ſhorter pæce is the eaſier to be taken in, both for the ſhortneſſe and the weight alſo.

In like manner, the ſhorter that the pæce lyeth out of the ſhips ſide, the leſſe it ſhall annoy them in the tackling of the ſhips ſayles, for if that the pæce doe lye very farre out of the ſhips ſide, then the Sheetes and Tackes, or the Bolynes will alwayes be foule of the Ordnance, whereby it may much annoy them in foule weather, and ſo forth.

And it is very good for you to haue long Ordnance to be placed right out of the ſterne of the ſhip for two cauſes: the one is this.

The pæce muſt lye very farre out of the porte, or elſe in the ſhooting, it may blow vp the Counter of the ſhips ſterne.

And alſo, the pæce had næde be very large, for elſe it will not go very farre out, for the worke of a ſhips ſterne hangeth very farre outwards from the decke or Vlloppe vp to the port, ſo that the carriage may be cloſe below, but not aloft, &c. And alſo if you haue any chaſing pæces to ſhoot right forwardes, then they muſt be long Ordnance, in like manner, ſo that you muſt fit your Ordnance, according vnto the place that it muſt lye in, and alſo (as is before rehearſed) that it is not good for to haue the mountance or carredge to high. Therefore, if that the Vlloppe or decke be too low vnder the port, then it is good for you to make a platforme vnder the port, that the trockes of the carrege may ſtand vpon. And alſo, when you doe take the meaſure of the port, from the decke or Vlloppe, to the end to fit the mountance or carriage in height, that the pæce may lye right in the middle of the port, then you viewing the decke or Vlloy, and conſidering what height

you will haue the whéele or Trocke, and also marke whether or how that the ships side doth hang inwards, or outwards, and also the Cambring of the decke or Mylop, and then you perceiuing where the formost trockes doth or must stand, when that the carriage doth goe close to the port. Then where as the very middle of the foremost trockes doth stand, there take the true measure in heigth from the Decke or Mylop, vpwards, and so shall you know iustly how many inches will lay the péece right in the very middle of the port: for if you doe take the measure of the heigth of the port from the port downe vnto the Decke or Mylop, then by the meanes of the Cambering, the Decke or Mylop, and also the wheels or Trockes doth not come to stand right vnder the port, so by that meanes the Decke or Mylop is higher inwards, and that shall cause you to make the mountance or carriage too high, for that the whéeles or Trockes that the carriage lyeth vpon, shall be a foote more or lesse into the ship-wards, and then looke into the Cambering of the Decke or Mylop, that it riseth inwards more, than it is right vnder the Port, you shall take the measure so much too high for the péece to lay her right in the middle of the Port, &c.

CHAP. 17.

How to shoot at a moueable marke vpon the land, and also what kind of shot is the best to be vsed, according vnto the cause, &c.

AND furthermore, to shoot at any moueable marke vpon the land, either at Horsemen, or at footmen, when you doe see them comming, then place your Mydnance vpon some marke in their way, as right vpon some bush, or any other marke that is in the high way, that they must come by, or most specially, at some place where there is a turning, for in a turning, there they doe tarrie longest before they be altered from the marke, and then it is best shooting off your Mydnance to doe any spoyle: and also vpon the land, you may try what any péece will doe at any marke, as touching the kéeping of the length of the marke, &c. And furthermore, as touching this, to know what kind of shot is most méetest to bée vsed to doe seruice in a field, or otherwise, with their great Mydnance, as Cannons, or Culuerings, at a great distance, to shoot the whole iron shot as you doe at battery, and as they doe approch neere, then to shoot Faucon shot, and as they doe come neerer, Faconet-shot, or small base shot, and at hand all manner of spoyling shot, as chayne shot, or clime shot, and dise shot, and such other like, &c.

CHAP. 18.

How you ſhall know if any peece of Ordnance bee ſufficiently mettalled, and alſo the cauſe that the Cannons do not occupie the weight in Pouder that the ſhot weigheth.

FOr to know whether that any peece of Ordnance be ſufficiently mettalled to beare her charge with Pouder, then this is generall, that in the Chamber before the tutchhole, ſo farre as the Pouder doth reach to the mouthwards, that the mettall be in thickneſſe as high as the ſhot round about the ſides of the peece, and ſomewhat thicker, and if that the mettall be not in thickneſſe as much as the height of the ſhot, then ſhe is too ſlenderly mettalled, &c.

And furthermore, the cauſe why the Cannons and other great Ordnance doth not ſhoot ſo much Pouder in weight as the ſhot weigheth, although that the rule and order of the founders of Ordnance, is to caſt the thickneſſe of the mettall as much as the ſhot is in height of all ſorts of peeces, as well in Cannons, as in all other ſortes of peeces, and yet the Cannon may not haue the weight in Pouder that the ſhot weigheth, as all ſmall Ordnance hath.

And furthermore, the cauſe thereof groweth by this meanes, for in the doubling the thickneſſe of the mettall of the peece, it doth but increaſe as a platforme, or ſuperficiall, that is, for double meaſure, to be foure times the quantitie. And as for the ſhot in the doubling of the meaſure, it is eight times the quantitie, and ſo it is in all bodyes, as Cubes, or Globes, and ſuch other like, as I doe more at large declare in the third part of my booke, called A treaſure for Trauellers. And yet you ſhall haue this example here by a ſhot of three inches high, and that ſhot weigheth 3 l. three quarters, the peece being a Minion, and the mettall is three inches thicke. And now I haue another peece that the ſhot is double the height, that is, ſixe inches high, and the ſhot will weigh thirty pound, and now the mettall being double, is but ſixe inches thicke, and the bigger ſhot is eight times the bigneſſe of the leſſer, and the meaſure but double, yet notwithſtanding, the diuerſitie is not ſo much as it ſeemeth: for if that both the peeces were caſt of one length, and double in meaſure, in compaſſe in all places, then the bigger peece ſhould weigh foure times the weight of the leſſer. And this is the cauſe, that the Cannons muſt not haue the weight in pouder that the ſhot waigheth, for the weight of the peece, and the weight of the ſhot, muſt rule the matter, as I doe plainely ſhew in the third Chapter of this booke going before.

CHAP. 19:

In what order you ſhall give levell with your Ordnance at a battery, to beat down the walls of any place, and alſo what to obſerve, in the giving fire unto them.

I doe thinke, it is not unmeet to ſhew by what order you ſhall give your levell, and ſhoot off your Ordnance at a Battery, that is to ſay, to beat down, or ſhake downe, or ſhake downe the walls of any Towne or fortreſſe: and for the beating them down in the giving of your levell, and ſhooting them off, do this: after that you have planted your Ordnance, either in two places, or in three places, as the place doth require, but in my opinion, two places is ſufficient unto one place, to beate it downe, to the intent to make a breach, and if it bee unto a Collion point, then it is beſt to place your battrey but into two parts, and otherwiſe as the place doth require, and then in giuing of levell, do this. Firſt, whereas you do mean to begin to make the breach, and being but at on place of your Ordnance, giue levell with one peece below, at the bottome of the wal, and with the nert peece a foot higher right ouer that, and with the third, right a foote ouer that, and ſo forth unto every peece at that part of the battery, ſauing you need not give the levell unto no peece, more then three quarters the height of the wall, and then in like manner, giue your levell with your peeces at the other part of your battry, unto that place that the other part was laid right againſt, within a fadome or more, at your diſcretion, as the place requireth, ſo that the one place may flanck or beat againſt the other, croſſing in the middle of the wall, and when you doe mean to ſhoot them off, then give fire unto them all at once, at both the places, that they may all beat and ſhake the wall at one time together, and then it will beate it down or ſhake it downe the ſatter, and the bottome being beaten away, the top will fall away of it ſelf, and ſo when that you have broken the wall, and will do make it wider, then giue levell at your diſcretion upon the wall, obſeruing the order before rehearſed, both in the levelling, and of the giuing of fire unto the peeces, &c.

CHAP.

CHAP. 20.

The weight of all manner of caſt peeces of Ordnance, from the Cannon, unto the Fauconet, and alſo the weight of the Shot, and the weight of the Pouder that they doe occupie, with the height of the ſhot and length of the peece, and all ſuch other like cauſes, according unto the names of the peeces, &c.

AND furthermore, I do thinke it conuenient, to ſhew unto thee the weight of the ſhot, and the weight of the Pouder that they do weigh, and the length and breadth of the Ladle, and the weight and length of the peeces, according unto their names. And firſt, for the Cannons, and there be of ſundry ſorts. The eldeſt and biggeſt ſort of the double Cannons, the mouth of them is in height 8. inches and a quarter. The ſhot is in height 8. inches, and weigheth about 70. pound of iron, and the weight of the peece is about 8000. and in length, about 12. foot more or leſſe, and compoſeth in Pouder, 46. pound Serpentine. The length of the Ladle is 24. inches, the breadth of the Ladle is 15. inches ½ &c.

The ordinary double Cannons, the peece is 8. inches high in the mouth, the ſhot is in height 7. inches three quarters, it weigheth of iron about 64. pound, and the weight of the peece is about 7500. and in length neere about eleuen or twelue foot long, and occupieth in Pouder 42. pound Serpentine, the length of the Ladle is 23. inches a quarter, the breadth thereof fifteene inches ¼ and the compaſſe of the ſhot is foure and twenty inches.

The French double Cannons, the peece is in the mouth ſeuen inches three quarters, in height the ſhot ſeuen inches ½ high, and weigheth being of iron about 58. pound, and the peece weigheth about ſeuen thouſand, and is in length as the other before rehearſed, compoſeth in Pouder neere fortie pound Serpentine: the length of their Ladles is but fifteene inches, for that they doe lade their peeces with three Ladlefuls, and we here in England but with two, and the breadth of the plate of their Ladle is fifteene inches, &c.

Demy Cannons.

AND firſt the Demy Cannons of the eldeſt ſort, the peece is fiue inches three quarters in height, in the mouth, the ſhot fiue inches and a halfe in height: the ſhot of iron weigheth eight and thirty pound, and the weight of the peece is neere fiue thouſand pound, and in length eleuen or twelue foote long, and occupieth in Pouder

ſixe and twenty pound Serpentine, the length of the Ladle three and twentie inches, the breadth of the plate of the Ladle twelue inches $\frac{3}{5}$ parts, and the compaſſe of the ſhot is twenty inches, $\frac{1}{7}$ parts.

The ordinary Demy Cannon, the height of the mouth is ſixe inches and a halfe, the height of the ſhot ſixe inches a quarter, the weight of the ſhot in iron thirty three pound, and the weight of the peece is about 5500.l. and the peece is in length ten or eleuen foote, and her charge in Pouder is foure and twenty pound Serpentine, the length of the Ladle is two and twenty inches, and the breadth of the plate of the Ladle is twelue inches.

Some ſorts of Demy Cannons, the height of the mouth of the peece but ſixe inches, a quarter, the height of the ſhot ſixe inches, the weight of the ſhott of yron thirtie pound, and the weight of the peece ſiue thouſand, or 5400.l. the length as afore, her charge in Pouder foure and twenty pound Serpentine, the length of the Ladle three and twenty inches, the breadth eleuen inches and a halfe.

The French Demy Cannon, and of ſome other forraigne Nations, the height of the mouth of the peece but 6. inches, the height of the ſhot fiue inches three quarters, the weight of the iron ſhot ſixe and twenty pound l. and the weight of the peeces fiue thouſand more or leſſe, their lengths of the ordinary ſort, and ſhooteth in Pouder two and twenty, or three and twenty pound Serpentine, the length of the Ladle ſixteen inches, and three Ladle-fuls to charge the peece: the breadth of the Ladle eleuen inches.

Culverings.

THe elder ſort of whole Culuerings, called of ſome Norborow Culuerings, the height of the mouth of the peece fiue inches and a half, the height of the ſhot 5. inches a quarter. The weight of the ſhot in iron 20. pound. The weight of the peece, 4800. more or leſſe, their lengths deuided, as 12. or 13. foot long, and ſhooteth in Pouder, 20. pound Serpentine, the length of the Ladle 23. inches, the breadth of the Ladle neere ten inches, &c.

The ordinary whole culuering, the height of the mouth of the peece 5. inches a quarter, the height of the ſhot 5. inches. The weight of the ſhot of iron 17. pound. The weight of the peece about 4500. more or leſſe, the length of the peece 12. foot, and compoſeth in Pouder, 18. pound Serpentine, the length of the Ladle 25. inches, the breadth 9. inches, d. &c.

Culuerings not ſo high as ordinary, the height of the mouth of the peece 5. inches, the height of the ſhot foure inches three quarters, the weight of the ſhot 15. pound, the weight of the peece more or leſſe, 4300. the length of the peeces diuers, ſome the ordinary length, ſome otherwiſe, and occupieth in Pouder 16. pound, or therabouts Serpentine, the length of the Ladle 24. inches, the breadth 9. inches.

Demy

Demy Culuerings.

THe elder ſort of Demy Culuerings, the height of the mouth of the peece. 4. inches three quarters, the heigth of the ſhot. 4. inches ½. the weyght of the ſhot. 12. lb. d. of yron, the weight of the peece. 3200. the length of the peece. 12. foote more or leſſe, and their charge in Pouder 12. pound Serpentine, the length of the Ladell, 22. inches, their breadth. 8. inches. d. &c.

The ordinarie Demy Culuring, the heigth of the mouth of the peece. 4. inches d. the heigth of the ſhot 4. ynches a quarter, the weight of iron ſhot. 10. pound, three quarters, the weight of the peece. 27. hundred or there abouts, the length of the peece. 10. foote more or leſſe, and will comport in Pouder. 11. oz. 12. pound Serpentine, the length of the Ladell. 21. inches a quarter, the breadth. 8. inches.

Demy Culuerings lower than ordinarie, the height of the mouth of the peece. 4. inches a quarter, the height of the ſhot. 4. inches, the weight of the ſhot being of iron is neere. 9. pound, the weight of the peeces. 22 hundred more or leſſe, the length of the peece. 9. or 10. foote more or leſſe, and their charge in Pouder. 10. pound oz. 10. pound d. Serpentine, the length of the Ladell. 20. inches, the breadth. 7. inches, three quarters. &c.

Sakers.

SAkers of the oldeſt ſort, the heigth of the mouth of the peece. 4. inches, the heigth of the ſhot. 3. inches three quarters, the weight of the iron ſhot. 7. pound a quarter, the weight of the peece. 1800. the length of ſome of thoſe peeces. 10. foote, and comporteth in Pouder. 7. pound a quarter Serpentine, the length of the Ladell. 17. inches, the breadth. 7. inches a quarter.

Sakers ordinarie, the heigth of the mouth 3. inches three quarters, the heigth of the ſhot. 3. inches a halfe, the weight of the ſhot of iron is neere. 6. pound, the weight of the peece. 1500. the length of the peece. 8. foote oz. 9. foote, and her charge in Pouder is 6. pound, or thereabout of Serpentine Pouder, the length of the Ladle is. 15. inches three quarters, the breadth. 6. inches. 3. quarters. &c.

Sakers lower than ordinarie, the heigth of the mouth of the peece three inches and a halfe, the height of the ſhot 3. inches a quarter, the weight of the ſhot of iron. 4. pound three quarters, or neere. 5. pound, the weight of the peece. 1300. oz. 1400. the length of the peece, 8. foote, or thereabouts, and comporteth in Pouder. 5. pound, or 5. pound d. Serpentine, the length of the Ladell is fifteene inches, the breadth five inches and a halfe.

Mynions.

Minyons.

THe Minyon is. 3. inches and a quarter high in the mouth, the ſhot is three inches high, the weight thereof of iron, is three pound three quarters, the weight of the peece, neere about 1000. The length of the peece eyght foote or thereabouts, and ſhooteth in Pouder three pound three quarters, or neere foure pound Serpentine, the length of the Ladell thirteene inches d. the breadth 5. inches and a halfe, ſome forraign peeces lower. The ordinarie Minyon, the mouth three inches high, the ſhot but two inches three quarters, and weieth of iron neere three pound, the weight of the peece about nine hundred, the length of the ordinarie Minion, and ſhooteth in Pouder three pound or thereabout, the length of the Ladell. 13. inches, the breadth. 5. inches. &c.

Faucons.

THe Faucon, the heigth of the mouth of the peece. 2. inches three quarters, the heigth of the ſhot, 2. and a halfe, the weight of the iron ſhot. 2. and halfe a quarter of a pound, the weight of the peece ſeuen hundred, or ſeuen hundred and fiftie pound, the length of the peece ſeuen foot more or leſſe, and occupieth in Pouder two pound and a halfe, and the length of the Ladell is twelue inches and a halfe, the breadth of the plate of the Ladell is. 4. inches and a quarter, &c.

Some forraign Ordnances not ſo high as the Faucon, and the mouth of the peece. 2. inches and a halfe high, the ſhot. 2. inches and a quarter high, and weigheth neere one pound three quarters, and the weight of thoſe peeces fiue hundred, or fiue hundred and fiftie pound, the length is as the Faucon, and the charge is in Pouder neere two pound, the Ladell is eleuen inches and a quarter, the breadth foure inches.

A Fauconet, the peece is. 2. inches and a quarter high in the mouth, the ſhot two inches high, and the iron ſhot weigheth one pound, and neere halfe a quarter of a pound, and the weight of the peece is about 360 or. 400. and the length fiue or ſixe foote, and the charge is of Serpentine Pouder, one pound and a quarter, Ladle is ten inches long, and the breadth of the plate of the Ladell. 3. inches three quarters. And thus much I haue ſaid as touching all manner of peeces that ſhoot iron ſhot, thinking this ſufficient for inſtructions.

CHAP. 21.

CHAP. 21.

How many ſhottes of Pouder there is in a Laſt of Pouder, from the Cannon, vnto the Fauconet: and alſo, if that you are at any batterie, or in any Towne, Caſtell, or Ship, how to know how much Pouder will ſhoot all your Ordnance, &c.

AND alſo, I doe thinke it neceſſary for all ſorts of Gunners, to know how many ſhots of Pouder they may haue either in a laſt of Pouder, as alſo in a hundred pound of Pouder, according vnto the peeces, whereby they may readily know, if that they haue any charge of Ordnance in any Towne, Caſtell, Fort, or Ships, that they may know whether that they haue Pouder to lade all their Ordnance throughout, and alſo how oftentimes about, that they may ſhoot all their Ordnance with ſo much Pouder. And alſo it is very neceſſary, if that there be any Ordnance placed againſt any towne or fort, and if that they haue any number of great Ordnance, as Cannons ſuch a number, and Demy Cannons ſuch a number, to the intent to batter downe the walles thereof: and then it is very neceſſary to know how much Pouder will ſhoot all thoſe Ordnance off at one time, and ſo forth, if that they would continue the battery, to ſhoot. 40. or 50. times ouer all their Ordnance in one day, and ſo to know how many laſt of Pouder that the batterie will require to continue ſuch a number of dayes: wherefore I do think it conuenient to ſhew vnto you what a laſt of Pouder is and that is this, a Laſt of pouder is 24 hundred weight caske and all, euery hundred weight to containe. 112. pound, ſo that you may make your accompt, that you haue 24. hundred pound of Pouder in euery laſt, and ſo is allowed 12 pound in euery 100. weight, for the caske, which is in all allowed for the caske of a laſt of Pouder, 288. pound. &c.

And firſt this: the biggeſt ſorts of double Cannons doe occupie at one ſhot. 46. pound of Serpentine Pouder, and you haue. 2. charges in 100. of pouder, and eight pound remaineth ouer, ſo that you haue 52. ſhottes of Pouder in a laſt of Pouder, and 8. pound remaineth ouer. And if that it be ſuch a double Cannon, as doth occupie but 40. pound of Serpentine Pouder, then you haue 2 ſhots and a halfe of Pouder in euery. 100. weight of Pouder, that is iuſt. 60. ſhots in a laſt of Pouder. &c.

And alſo, thoſe Demy Cannons that doe ſhoot. 24. pound of Serpentine Pouder at one ſhot, they ſhall haue foure ſhots in a hundred weight of Pouder, and foure pound remaineth ouer, and that is a hundred ſhots in a laſt of pouder, iuſt, &c.

¶ And also those Culuerings that doe shoot eightteene pound of Serpentine Pouder at one shot, then there is fiue shootes in a hundred weight of Pouder, and then there remayneth ouer ten pound, so that there is a hundred thirty three shots in a Last of Pouder, and six pound remaineth ouer. And furthermore, those Demy Culuerings that do shot eleuen pound of Serpintine Pouder at one shot, then there is nine shots in a hundred weight of Pouder, and one pound remaineth ouer, so that there is two hundred and eightéene shots in a last of Pouder. &c. And also for those Sakers that doe shoot sire pound and a halfe of Serpentine Pouder at a shot, then there is fiftéene shots in a hundred weight and two or three pound remaineth, so that there is. 369. shots in a last of Pouder. And furthermore, for Minions that shoot foure pound of Pouder at one shot, then there is. 25. shots in a hundred weight so that there is six hundred shots in a last of Pouder. And also those Faucons that doe shoot two pound and a halfe of Pouder at a shot, then there is forty shots in a hundred weight, so that there is, 960. shots in a Last of Pouder. And in like manner those Fauconets that doe shoot one pound and a quarter of Pouder at a shot, then there is. 80. shots in a hundred weight, so that there is. 192. shots in a last of Pouder. And thus much I haue said, as touching how many shots of Pouder, according vnto the péeces, that there either is a hundred weight of Pouder, or in a whole last of Pouder. And furthermore, if you desire to know how much Pouder would shoot off all the Ordnance, either in a Towne, Fort, or Ship, then looke how many péeces there is of euery sort, and so vntill that you doe know how many péeces there is of euery seuerall sorts through a whole Towne, or Castell, or Ship, and then looke how many péeces there is of one sort, multiplie the number of those péeces by the weight of the Pouder, that one of those péeces doth shoot at one shot, and that will shew vnto you how many pound of Pouder will serue all one sort of péeces, and by this order multiply euery seuerall sorts of péeces by themselues, and then adde all your numbers together, and that shall shew vnto you how much Pouder will shoot all your Ordnance off at one time. As for example this. There is a Towne, that hath 3. double Cannons, and. 6. Demy Cannons, and. 14. double Culuerings, and. 10. Demy Culuerings, and 30. Sakers, and. 25. Minions, and. 28 Faucons, and. 12. Fauconets, and. 36. Foulers, and my desire is to know how much Pouder will serue all these péeces: therfore first, the. 3. double Cannons, and they do shoot 40. lb. of Pouder, and. 3. times. 40. is. 102. and then the Demy Cannons doe shot. 24. lb. of Pouder, and. 6. times. 24. maketh. 144. lb. of Pouder, and then the 14. double Culuerings and they doe shoot. 18. lb. of Pouder, and. 14. times 18. maketh. 252. and then the 20. Demy Culuerings and they shoot, 11. lb. of Pouder, and. 20. times. 11.

maketh

maketh. 220. and now the 30. Sakers and they doe shoot. 6. lb. and a halfe of Pouder, and. 30. times. 6 ½ is. 195. and then the. 25. Minions, and they doe shoot. 4. lb. of Pouder, and 25. times. 4. maketh. 100. and then the 28. Faucons, and they doe shoot 2. lb. and a halfe of Pouder, and. 28. times. 2 ½ doth make 70. and then the. 12. Fauconets and they doe shoot. 1. lb. and a quarter, and. 12. times 1. ¼. doth make. 15. and now the 36. Foulers and they doe shoot. 2. lb. ¼ of Pouder, and. 36. times. 2. ¼ maketh. 90. and now this being done, then adde all your numbers together, as this.

Names of peeces.	Peeces number.	Pouder in pounds.
Cannons.	3	120. pound.
Demy Cannons.	6	144 pound.
Culuerings.	14	252. pound.
Demy Culuer.	20	220. pound.
Sakers.	30	195. pound.
Minions.	25	100. pound.
Faucons.	28	70. pound.
Fauconets,	12	15. pound.
Foulers.	36	90. pound.
Summe totall.	174	1206. pound.

And now by this you may conclude, that all this Ordnance doth shoot at one time, to shoot them off round once ouer doth require. 1206 lb. of pouder, and by this order you may know at all times, whether you are in any Towne, fort, Castell, or Ship, how much pouder will serue all the Ordnance at your pleasure. And furthermore, if so be you haue such a quantity of pouder, and if you would know how oftentimes it would shoot all your Ordnance round about, then you knowing how much pouder will shoot all your Ordnance once, and as by the order before is repeated, then diuide your whole summe of pouder by that number of the weight of the powder that all your Ordnance requireth, and that summe that standeth in the quantity line, shall shew you how oftentimes it will shoot all your Ordnance off: As for example, by the Ordnance in a Towne (as before is rehearsed) and suppose you haue. 20. Last of pouder, and now to know how oftentimes it will shoot all your Ordnance off round thorough the whole Towne, as you did see that all the Ordnance did require 1206. lb. of Pouder, and one Last of Pouder is 2400.

lb. then 20. Laſt maketh 48000. lb. wherefore deuide. 48000. by 1206. and then there will ſtand in the quantity line. 39. and 966. lb. will remaine ouer, ſo you may conclude, that twenty Laſt of Pouder will ſhoot all the Ordnance before rehearſed. 39. times ouer, and three quarters of them more, that is to ſay, that it will ſhoot all the Ordnance off fortie times, lacking almoſt a quarter of them, &c. And alſo, if there were any batterie laid againſt a Towne, and then if that you doe know how many Cannons or other peeces of Ordnance there is in the batterie, then you may know (as before is rehearſed) how much pouder that they will occupy at once ſhooting them off, and alſo if that you will ſhoot them off round fortie or fifty times in one day, then you may know how much pouder they will ſpend in one day: as this firſt (as before is rehearſed.) Multiply all the Ordnance of one ſort together, by the weight of the ſhot of pouder, and ſo the other ſorts of Ordnance, and adde them together (as afore is ſaid) and that being knowne, then multiplie that by the number of times that you haue ſhot them off, and that ſhall ſhew vnto you the number of pounds that the Ordnance hath occupied in that day: as for example this: Suppoſe that there is in a battery againſt a Towne. 24. double Cannons, and they doe ſhoot. 40. pound of pouder a peece, therefore multiplie. 24. times 40. and of that multiplication, there commeth 960. and then there is eightéene Demy Cannons, and they doe ſhoot 24. pound of pouder a peece, and therefore multiply eightéene times. 24. and that maketh. 432. pound, and then adde both the numbers together, that is to ſay. 960. and. 432. and they will make 1392. ſo that you may ſée, that the whole battery doth ſpend 1392. of pouder at once ſhooting thereof againſt the wall of the Towne: and then ſuppoſe, that in a day the Ordnance hath béene ſhot off ſix and fortie times, then how much pouder ſhall be ſpent that day: then multiplying 1392. by ſixe and fortie, and that will make 64032. ſo that you may conclude that the whole batterie hath ſpent in one day, 64032. pound of pouder, and that will be ſixe and twentie Laſt and a halfe, and 432. pound of pouder, and then if that the batterie ſhould continue ſeuen dayes in that order, the whole ſumme in pouder that ſhould be ſpent, amounteth vnto 448224. pound, and that maketh 186. Laſts, three quarters, and 24. pound: therefore by this order you may know from time to time, how much pouder is ſpent at your pleaſure, whether that it be in a batterie, or in a Towne, and alſo how much pouder will ſhoot ſuch a number of Ordnance ſo many times off at your pleaſure. And thus much I haue thought good to write vnto you for inſtructions, &c.

CHAP. 22.

CHAP. 22.

How to know how many ſhot doth weigh a Tunne.

And now in ſo much as I haue ſhewed in the Chapter going before, to know how much Pouder is occupied in Ordnance: ſo in like manner, I doe thinke it conuenient to ſhew vnto you how many ſhots of euery ſeuerall ſort will weigh a Tun weight, which is very neceſſary to be knowen, as well for them that haue occaſion to tranſport them either by Sea or by land. And firſt this, a tun weight is 20. hundred, and euery hundred for to containe an hundred and twelue pound, ſo that a Tunne is 2240. pound in weight: and firſt, the double Cannons ſhot, and thoſe that doe weigh 64. pound, and then 35. ſhots doth weigh a Tun: and then the Demy Cannons ſhots, and thoſe that do weigh 34. pound a peece, and then 62. or 63 of thoſe ſhots doe weigh a Tun: and the Culuering ſhot of ſeuenteen pound a peece, and then 131. or 132. will weigh a Tun: and alſo the Demy Culuerings, and thoſe ſhots that do weigh ten pound a peece, and then there is 224. in a Tun. And furthermore, thoſe Sakers, that the ſhot doth weigh fiue pound, and there doth goe 373. or 374. vnto a Tun: and in like manner the Minions, and commonly their ſhots do weigh three pound three quarters, and 597. or 598. ſhots will weigh a Tun. The Faucons ſhots doth weigh two pounds halfe a quarter, and 1054. or 1055. doth weigh a Tun, and the Fauconet ſhot weigheth one pound, and neere halfe a quarter of a pound, and 1991. or 1992. doth weigh a Tunne. And thus much I haue ſaid, as concerning how many ſhots of euery ſeuerall ſort doth weigh a Tun weight, but if that you haue a great number of ſhotts of ſeuerall ſorts, and you doe deſire for to know how many Tuns there is in all of them, multiply euery ſeuerall ſort by themſelues, according vnto the weight, and ſo adding all the numbers together, and then deuide that number by 2240. and it will ſhew vnto you how many Tunnes there is in the whole ſumme. As for example this, there is ſuch a number of ſhots to be tranſported, either by Sea, or by Land, and you would know how many that there is of them: as firſt, that there is a thouſand Cannon ſhots, and a thouſand two hundred Demy Cannon ſhot, and two thouſand Culuering ſhot, and 3000. Demy Culuering ſhot, and three thouſand fiue hundred Saker ſhot, and foure thouſand Minion ſhot, and fiue thouſand Faucon ſhot, and fiue thouſand Fauconet ſhot: and now for to know their weight, and firſt for the Cannon ſhot, and thoſe that be 7. inches three quarters high, and thoſe doe weigh 64. l. a peece, and then being a thouſand ſhot then therefore multiply a thouſand times 64. and that maketh 64000. and then there being 1200. Demy Cannons ſhot, that are fiue inches a quarter high, and thoſe doe weigh foure and thirty pound a peece,

and therefore multiply 1200. times 34 and that maketh 40800. and then there is 2000. Culuerings shot, of fiue inches almost in height, and they doe weigh 17. pound a peece, and then multiply two thousand times seuenteene, and that maketh 34000. and then there is 3. thousand Demy Culuering shot, of neere foure inches and a quarter in height, and they do weigh ten pound a peece, therefore multiply three thousand times tenne, and that maketh 30000. and then there is 3500. Saker shot, that is three inches and a halfe high, and that weigheth 6.l. and therefore multiply 3500. times 6. and of that there commeth 21000. and then there is 4000. Minion shot, of iuſt 3. inches high and they doe weigh 3.l. 3. quarters a peece, and therefore multiply, 4000. by 3 ¼ and that will make 15000. and then there is 5000. Faucon shot, and they be two inches and a halfe high, and doth weigh 2.l. and halfe a quarter: therefore multiply 5000. by 2 ⅛ and that will bee 10625. and then there is 6000. Fauconet shot, of two inches high, and they do weigh one pound, and halfe a quarter, and that commeth in weight 6750. and now adde all your numbers together, as by this example following.

Names of Peeces.	Number of Shots.	Weight in Pounds.	Tunnes.
Cannons.	1000	64000	28 4/7
Demy Cannons.	1200	40800	18 1/14
Culuerings.	2000	34000	15 1/2
Demy Culuerings.	3000	30000	13 1/28
Sakers.	3500	21000	9 1/56
Minions.	4000	15000	6 1/16
Faucons.	5000	10625	4 1/448
Faconet.	6000	6750	3 1/224
Sum totall.	25700	222175	99 1/448

And now, all those numbers being added together, doth make 222175. pound in weight. And now to know how many Tunnes there is in all them, deuide the 222175, by 2240. and that being done, then there will stand in the quantity line 99. and 415. will remaine ouer, so that you may conclude, that of all the shot there is 99. Tuns, and 415.l. that is neer ¼ part of a Tun more, so that there lacketh little more then three quarters of a Tun of 100. Tuns, and by this order or means you may know how many Tunnes of shot there is in any number of shots, &c.

CHAP.

CHAP. 23.

How and by what order the ſhot doth graze or glance upon the land or water.

FOR to knew by what order that the ſhot doth graze or trondle, either vpon the land, or the water, it is to bee noted, that it doth graze or trondle farthest, when that the peece is laid point blanke if that you do ſhoote the peece towards the water, or a plaine, or leuell ground, and then the ſhot ſhall run or graze neere three quarters of the beſt compaſſe of the Rander, ſo that the ſhot bee not let by any chance by the way and there is on great diuerſity in diſtance of the grazing or running of the ſhot, betweene the land and the water, ſo that the ground be a plaine and leuell ground, and the water or Sea too be ſmooth. And here is one thing to be noted, as touching the grazing of the ſhot, whether it be upon the water or the land, looke by what proportion the ſhot doth ſtrike or hit the ground or water, by that proportion the ſhot ſhall riſe againe, although that it flyeth not ſo farre in that proportion, as long as the ſhot hath force or drift in his flying, that is to ſay, if the ſhot do ſtrike or hit any thing glauncingly that then it ſhall glance in that proportion from you-wards, and if it do ſtrike or hit any thing directly, then it ſhall be driuen directly backe againe, if it doe not enter or ſticke faſt in the thing that it hitteth, euen like the ſhadew of the Sunne, or any other thing in the water or glaſſe, or ſuch other like. As for example this. If you ſhoot any peece of Ordnance towards the water, and lay the peece at the point-blanke, and the peece be but little higher than the water, then ſhall the ſhot runne grazing in this forme, to riſe againe by that proportion that it doth hit the water, and ſo to runne, that the great force be decayed, as this example doth ſhew.

And

And furthermore, if you doe mount the peece at much aduantage, then it will not graze at all, if it doe graze, then it will be made in this manner.

And furthermore, if you doe ſhoot at any Ship vpon the water, and you doe ſhoot in that peece that doe lye very high, and the ſhip or marke neere hand, ſo that you muſt giue your leuell downewards, then if you doe giue your leuell ſhort of the ſhip, the ſhot will flye ouer the Ship, by the meanes of the direct hitting of the water, for that the ſhot doth glance from the water, by that proportion that it doth hit the water, as by this example.

So that you may iudge by this example, by what proportion the ſhot doth graze, either vpon the water or the land: but the water is the more certainer and truer if it be ſmooth and calme, for that the water is not harder in one place, than it is in another, as the ground is or may be, and the director that it hitteth either the ground or the water the more it doth kill the force of the ſhot, and by this meanes it will flye the leſſer way: and the more glauncingly that it doth hit either the ground or the water, the oftner it doth glance or graze, and the further it flieth, &c.

CHAP. 24.

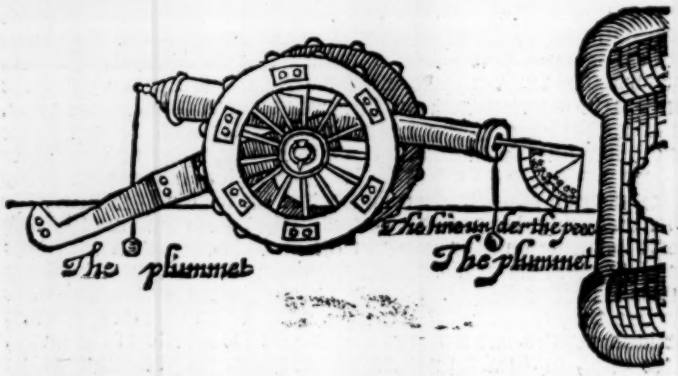
How to batter the walles of any Towne as well by night as by day.

ALthough it hath not bin commonly vſed, yet notwithſtanding it may be eaſily done, for to plant their ordnance ſo, that they may batter or beat down the walles of a Town as well by night as by day, although the night be neuer ſo darke. And alſo there ſhall no light appeare vnto the enemie, as thus. Firſt after that your Ordnance is placed for your batterie, & you haue begun to batter,

and

and then the peeces being made ready for to shoot at the wall, or place, that you do meane to shoot at, and that you would continue for to shoot at the place all the night, then take a Plummet of lead vpon a line or string, the peece being right vpon the mark that you do meane to shoot at, then with a Plummet and the line, first plumme the middle of the mouth of the peece downe to the ground, and looke where the leade falleth to the ground, there make a marke vpon the ground, and then in like manner plum the very middle of the taile of the breech of the peece vnto the ground, and there make a marke also vpon the ground, and then draw a right line from the one place vnto the other, as long as you list, and then that right line will lye right vpon the marke, then take a large great Quadrant, set out with degrees, and parts of degrees, and the Quadrant, for to haue a rule fastned vnto it, and then the peece being laid ready for to shoote at the marke, hauing the true height of the marke, that is to say, that the hollow or concauitie of the peece do lye right vpon the marke, neither higher nor lower: then put the rule into the mouth of the peece, and looke at what degree or place that the plummet line doth hang vpon, then note that in some Booke or paper, and then when that the night is come, and that you doe meane to shoot as well by night as by day, then first with your plummet of leade vpon a line, then plumme the mouth of the peece right vpon the line that is vnder the peece, and that will lay the peece right vpon the marke, and then in like manner take the Quadrant, and put the rule into the mouth of the peece, and then koyne the peece vp and downe till that the plummet line doth fall vpon that degree and place that it did before, and then that in like manner will giue the peece the true heigth of the marke without any faile. And for to see whether that the plummet line doth hang vpon the degree or place that it did before, and also to know by the line and the plummet with the line vpon the ground vnder the peece, for to lay the peece right vpon the marke, there must be prepared a close Bore like a Lanterne, made with boordes, with a doore or a lid for to open and shut, to the intent to see how the plummet doth hang, and so forth: as for example, supposing that at the seege of a Towne, the Ordnance being placed, and had battred all the day, to continue that they should not make vp their breach in the night, and furthermore, that the breach should be made wider in the morning, then they went vnto the middle batterie called the persers, and there tooke a plummet of leade and line, the peeces beeing all charged and leuelled vnto the breach and markes appointed, and first, the plummet at the middle of the mouth of the peece, and then right vnder the plummet, they doe drine in an iron pinne, and then in like manner at the taile of the peece, they plumme the peece, and right vnder the plummet they drine another pinne into the ground, and for that they could not draw a perfit line, they made a line or string fast, longer than the length of the distance of the

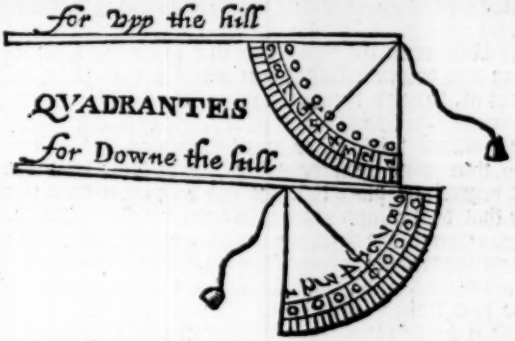
two pinnes by two yardes, and the line or threed did come right ouer the head of thoſe two pinnes, and ſo paſſed a yard further at both the ends, than the two pinnes: and thus they did lay euery peece at that place, and then the peeces lying ſtill, ready to haue fire giuen vnto them, then they take their Quadrant, being very large, of two foote in the ſemy Dyametre, that is to ſay, from the Senter of the circle, and euery degree was ſet out in foure parts, and put the rule into the mouth of the peece, and the plommet line did hang at one degree and a quarter iuſt, and that they did note in a booke for remembrance, and this being done, they ſhot off their peeces. And now when that the night was come, and the ſame very darke, and the morning very foggy, or that they could not ſee the walles of the Towne, yet they battered the walles of the Towne as perfitly all the night, and as well as though it had beene by day, for euery time that they had charged all their peeces, they did this, firſt, they did plomme the mouth of the peece, and likewiſe at the taile of the peece, right vpon the line that was vnder the peece, right vpon the marke, and then they tooke their Quadrant, and put their rule into the mouth of the peece, then ioined the tayle of the peece by and downe, till that the plummet line did fall vpon that degree and place that it did before the night, and that was at one degree and a quarter iuſt: and thus when they had laid all their peeces, then they ſhot them off, and charged them againe, and ſo continued all the night long.



And ſo in this manner, they may in like caſe handle the two ſide batteries, but and if that it chance that the battering peeces

by

doe lie vpon higher ground than the place that is battered, then the rule that is faſtned, muſt be vnto that place whereas the plommet is made faſt vnto, for that the degrees goeth downewards towards the lower ground as you may ſee by theſe two figures.



CHAP. 25.

How to plant Ordnance by night, to batter the walles of any Towne, or diſplace any Ordnance in any Bulwarkes, or any ſuch other like, as well by night as by day.

YEt furthermore, there may be meanes found, that if there be any Ordnance placed that doth damage or hurt you, and that you may not come at it by no meanes in the day for to diſplace their Ordnance, but vnto your great hurt and loſſe, both of men and Ordnance, yet you may diſplace them by night neere as well as by day, both for to place your Ordnance in the night, and alſo for to ſhoot perfitly vnto the place in the night, although the night be neuer ſo darke: and then if that you doe ſee cauſe, when that you haue beaten or diſplaced their Ordnance, you may carry away your Ordnance before it is day, as thus. Firſt, prepare an Aſtrolobe, the larger the better, and then two ſtakes or pinnes of iron like to a foote long, or thereabouts, according vnto your diſcretion, and alſo a ſledge or beetle, to driue thoſe ſtakes or pinnes into the ground, and then viewing the ground meete for the purpoſe a reaſonable diſtance from the place that you doe meane to beate in the night, goe into that place in the day time, and firſt where you doe meane for to lay your Ordnance, there driue in one of your ſtakes, and then in like manner

goe backwards about twenty foot, and ſtand ſo, that you may ſée the marke that you doe meane to ſhoote at ouer the top of the ſticke that you haue driuen, and then there in that very place driue your other ſtake, and then goe a little backwards more, and view whether that the two ſtakes ſtand as one right line unto the marke, and if that they doe not, you may amend them, and ſet them right, then take your Aſtrolobe, and hold that upon your thumbe by the ring, and then turn your Athilleyday, or Rule with the two ſights that is on the backſide of the Aſtrolobe up and downe, till that you may ſee that place that you do mean to ſhoot at, through the two ſights of the Athilleyday holding that up before your eies, winking with one of your eies, ſtanding at that place wher you doe meane for to place your Ordnance that is between the two ſtakes, then looke vpon the Athilleyday or Rule with the two ſights, at what degree and place that the end doth point vnto, then remember to write that degree, and place it in ſome Booke or Table, for that it is finiſhed: then in the night you may bring your Ordnance unto that place between the two ſtakes, and then place one of your péeces right betwéen the two ſtakes, and then take a threed or line, and make that faſt unto the two ſtakes, and that ſhall lay the péece right upon the marke. And then for to place the reſt, they muſt doe this. Firſt on the one ſide meaſure out juſt how many foote you doe meane to lay your péeces in diſtance aſunder, then from the line of the ſtake, meaſure it truly, and there make a marke, or driue a ſtake: and then at the other end, at that certaine diſtance, there in like manner driue another ſtake: then betwéen thoſe two ſtakes place another péece, & then make a line faſt vnto thoſe two ſtakes, and that in like manner ſhall lay the péece right upon the marke, & then you may place another péece, vpon the other ſide of the péece, and ſo forth. And then when your Ordnance is all charged, then plome the middle of the mouth of the péece right vpon the line, vnderneath the péece, and then in like manner, the middle of the taile of the peece to be plommed, that it ſtand right ouer the line, vnderneath the péece, and then take your Quadrant with the rule faſtned vnto it, and put the rule into the mouth of the péece, and then koyne the péece vp and downe, till the plummet-line doe fall vpon that degrée and place that the Athilleyday did point vnto, vpon the Aſtrolobe, and that ſhall giue the péece the true height of the marke. As for example, ſuppoſe this after the breach in the wall of the Towne was made ſaultable, there the flanckes lay ſo that they could not come nére vnto the breach, neither could they plant their Ordnance for to diſplace thoſe flanckes, but that they ſhould be beaten from their Ordnance to their great loſſe and hinderance: therefore firſt, they prepared an Aſtrolobe of the largeſt ſort, and two pinnes of iron made ſharp at the endes, to goe into the ground, and then they cauſed an aſſulte to be giuen vnto the contrary ſide of the towne, and whileſt they held them play there, then two or three chooſe out their ground méete for their

purpoſe,

purpose, and there drove one pinne, and then they went backe twenty foote, and right against that pinne they drove a nother pinne so euen, that the two pinnes, and the place of the Bulwarke where the flankers lay, were all there vpon one right line: and then one of them tooke the Astrolobe, hanging it perpendicularly vpright, then they turned the Athilleyday vp and downe, till he might see thorough both the sights, the very place that the flanckers lay, and then they departed, and went their way, and looked vpon what degree the point of the Athilleyday stood vpon, and found it to be vpon just two degrees and a halfe, and that they wrote in a booke for remembrance, and then after a night or two, when they saw their time, the night being very darke, then they carried three peeces of Artillerie, and placed the chiefest betweene the two pinnes, and vnto these two pinnes they made a line fast vnto them both close vnto the ground, and then they placed vpon the one side, one of the peeces, and the other peece vpon the other side, as this. First, they measured out ten foote from the formost pinne just vpon the one side, making a perfit square angle, and then in like manner they measured out. 10. foote more at the hindermost pinne, so that those two pinnes stood just. 20. foote asunder, and so placed the peece betweene those two pinnes: & now for that they must shoote all three peeces vnto one place where the flankers lay, and for that the peeces did lye 10. foot asunder, therefore they removed the hindermost pinnes of both the sides. 4. inches, so that there was. 10. foote distance, and 4. inches, and the cause was this, for that the marke was. 10 skore off from the place where the peeces lay, and the peeces lay just from the middle, vnto the middle, ten foote asunder, and the line vnderneath the peece, was just twentie foote long, and there is thirtie times the length of the line vnderneath the peece vnto the marke, & thirty inches maketh two foote and a halfe, and foure times two foote and a halfe, maketh ten foote, so that the hyndermost pinne being removed foure inches further off, must needes lay that line just vpon the marke that the middlemost lyeth vpon, without any faile, & in this order the one peece was placed on the one side, and the other peece on the other side: and now those peeces being charged, first they plome the mouth of the peeces right vpon the line, and then in like manner the breech or tayle right vpon the line, and then they tooke their Quadrant, and put the rule into the mouth of the peece, and kayned the breech of the peece, till the plummet line fell at two degrees and a halfe just, for that the Athilleyday did shew vnto them on the Astrolobe: and they shooting off those peeces, they made a perfit shot at the place appointed, and thus they charged and shot all the night, and then before day, when they had serued their turne, they conveyed their Ordnance from that place, for feare of being beaten away from them when it was day light.

And furthermore, by that meanes in like manner, they may place their Ordnance in the night out of a Towne, to annoy their enemies,

as they may or can by no deuice or practiſe, but by induſtry or policie they may be preuented by practiſe, and eſpecially if that he doe know what the enemie doth meane for to doe, for this we doe ſée many times in warres, that policie doth preuayle as oftentimes as great and huge armies of men of great ſtrength, hauing all kinde of engines for that purpoſe, for euen as it pleaſeth God, ſo goeth the victorie, although it commeth by a naturall cauſe, and that naturall cauſe that I ſpeake of, is knowledge and induſtrie in thoſe affaires.

CHAP. 26.

How to keepe a Haven or River on the Sea-coaſt, for to ſincke a Ship as well by night as by day in all pointes.

NOw for the kéeping of a hauen or Riuer, there may be ſuch meanes or wayes vſed by induſtrie, that you may kéepe a Hauen or Riuer in this ſort, ſo that there may no Ship paſſe neither by night nor by day, but that he ſhall be ſunke, or elſe he eſcapeth very hardly, although the night be neuer ſo darke, ſo that the night be not Foggy or Miſtie, ſo that the Hauen or Riuer be not aboue a mile broad or ouer, as this. Firſt, if the entrance of the Riuer be therefore, to haue a watch there, then as ſoone as the watch doth perceiue them and their number, then they muſt haue a watch token, and that muſt be a light or lights vnto the Caſtle or Bulwarkes, and then the watchtokens being ſo agreed vpon that the Caſtles or Bulwarkes may know the number of the Ships by the forme of the lights of the Caſtels or Bulwarkes, if that they be on the one ſide, and the other on the other ſide, then at certaine knowne places appointed for that purpoſe, and at a certaine diſtance from the Caſtels or Bulwarkes towards the Sea wards, each of them for to carrie a light thither, and to place the lights as nére the water as may be, and if that it chanceth ſo, that there is but one Caſtell or Bulwarke, and none vpon the other ſide, then they hauing a bote or Skiffe, or any other craft, they may rowe ouer the water, and place their Lights in that knowen place appointed, and then afore night, that place being alwayes knowen vnto them, they may place their Ordnance right vpon that marke vpon the farther ſide of the water, the Light ſtanding alwayes to the Seawards of the marke that the Ordnance is placed right againſt, like. 20. or. 30. fote, and then the night being neuer ſo darke, the light is the better ſéene: then muſt the Ships nédes in their comming betwéene the light and you, take away the lights of your lights, and then immediately, as ſoone as you doe ſée that the light is ſhadowed, then giue fire vnto thoſe péeces that be placed againſt your imagined marke appointed, and then there is no

doubt

doubt but you ſhall make a perfit ſhot at that Ship, being ſure that the mouth of the peece bee koyned low enough, leaſt they ſhould ſhoot ouer the Ship, and eſpecially if it be in a place where it doth ebbe and flow: for at the full Sea, they muſt koyne the peeces at one proportion, and at a low water, at another proportion: and this being handled diſcreetly, they ſhall not faile the hitting of the Ship. And furthermore, as it is declared in the. 2. Chapter going before, they may haue a line drawne vnderneath the peece vpon the ground for to lay their peeces right vpon their appointed marke at all times, after that they haue ſhot off their peeces in the night. then in the night they may place them againe, &c. As for example, here with vs at gravesend, as there is. 2. Bulwarkes the one right againſt the other, the riuer of Thames running betweene them, and now they would keepe the riuer ſo, that there ſhould no Ship paſſe, neither by night nor by day, but that they ſhould be ſunke: then they muſt keepe a watch at the Paſſe or poynt below, at the entrance of the Tilberrie hope, and that is a mile and a halfe from the Bulwarke, and there alwayes, they muſt needes ſee them, and their number of Ships, and ſpecially by the helpe of a light vpon the further ſide of the water, and then they being knowne vnto the watch, the watch muſt make vnto them a token by a light or lights that they haue agreed vpon before, and then thorough the watch token, the Bulwarke knoweth that their commeth ſuch a number of Ships, or but one or two as it chanceth, and then each of the Bulwarkes hath an imagined marke, twentie skore towards the Paſſe or Seawards, that they do alwaies plant their Ordnance right againſt it, both by day, and by night, and then as ſoone as they do ſee their watchtoken, then both the Bulwarks doe place their lights hard vnto the water, like twenty foote to the Seawards of their imagined marke: then the peeces being planted and koyned, ſo that the diſpart ſtandeth vnderneath the poynt blanke at the full ſea one degree, and at the low water three degrees, then giuing fire vnto the peece or peeces, as ſoone as the Ship taketh away or ſhadoweth the light, then therts no doubt but they do ſtrike the Ship very neere the water without any faile. And for that the light ſtandeth to the Seawards of the marke appointed, the ſhot muſt haue a time to come vnto the Ship, and the Ship goeth away in the meane time. And furthermore, when that the peeces bee charged againe, then the line that is vnderneath the peece, by plomming of her at the mouth, and at the taple of the peece, is laid right vpon the marke againe: and then furthermore, if the Ship chance to paſſe further, ſcaping both the Bulwarkes, then they may haue more imagined markes, and alſo lights placed there, and in like manner, lines vnderneath the peeces right vpon thoſe markes. &c. And furthermore, you may know by the lights, which ſide of the water the Ship commeth two wayes, and one way is this, the

land

land being higher then the water, and the lights being placed hard vnto the water, if that the ſhip commeth hard vpon the further ſide of the water nert vnto the light, then the hold of the ſhip will ſhaddow the light, and if that ſhe commeth on your ſide, then the ſayles will ſhaddow the lights. And furthermoze if the Ship commeth right in the middle of the water oz Riuer, then both the Bulwarkes ſhall haue the lights ſhaddowed at one time, and if the Ship come on the further ſide of the water from you, then your lights will be firſt ſhaddowed, and if on the ſide you be on, then your light will be laſt ſhaddowed: and then furthermoze foz the making of a perfit ſhot, if that the other Bulwarke ſhot befoze you, then koyne the mouth of the peece one degree lower, foz that the Ship commeth vpon your ſide of the water, and then foz the neereneſſe of her comming, you muſt needes koyne the peece ſo much the lower, &c.

FINIS.

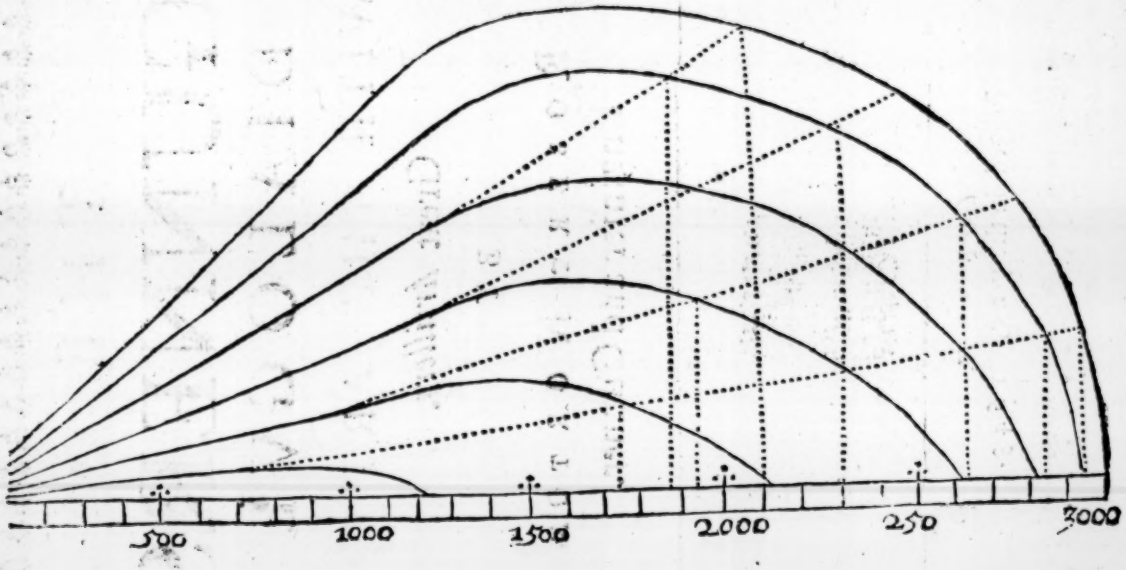
Some deſerve ere they deſire,
And yet ſhall lacke when they require,
Some deſire and never deſerve,
And gets the gayne the other ſhall ſterve.

THE GUNNERS DIALOGVE WITH THE ART OF Great *Artillery.*

BY

ROBERT NORTON
Enginier and Gunner.

LONDON,
Printed in the yeare, 1643.


500
1000
1500
2000
250
3000

TO THE MOST ILLVSTRIOVS PRINCE the DVKE of *Buckingham*

His Grace, &c.

Seeing that amongſt all the Arts (moſt Excellent Duke*) that adorne the life of Man vpon Earth,* Warre *is that higheſt, worthieſt, and moſt commodious* Science *that great Princes ought to preferre before all others, were it but for* Cicero *his reaſon,* Vt ſine injuria in pace vivamus; *Peace being by inſtinct of* Nature *of all men moſt deſired, And warre by the greateſt* Emperours *and* Princes *of the world ever with Sword and Pen moſt highly magnified, ingenuouſly finding therein innumerable inventions, and divers ſubtill ſecrets, and admirable devices,* Engins *and* Stratagems *to overcome their* Enemies *with; yet none comparable to the Art and Practice of* Artillery, *comprehending in it the greateſt matter of importance of our* Militia *at this day. And finding alſo (Great* Duke*) many ardent magnanimous minds to coole, for want of ſpeculation to invent; and divers Heroicke actions to paſſe by vnatchieved, for want of practice to performe: I, the meaneſt of many, having with long practice, and no ſmall ſtudy, and ſome coſt, beene ſomewhat inſtructed and converſant therein; and ſeeing the penury of expert* Gunners, *and vnderſtanding men, and the weakneſſe of the preſent meanes to breed*

more hereafter, I have for aid formerly offered my poore Talent, called the Art, *and the* Practice of Artillery. *And now alſo depending upon your* Graces *favour, preſume to offer theſe few lines, called the* Gunners Dialogue, *under your Excellencies Patronage, as well to further others therein, as herein to ſhew ſome part of my thankfulneſſe for your* Graces *favour, that it pleaſed you to imploy my ſervice, were it but to view and cenſure other mens workes, (I being not naturally ſcrutinous) wherein I proteſt I faithfully related to your* Grace, *my poore opinion truly, if not judiciouſly, the effect, if they be put in practice will manifeſt, but certainly cleere it was from all partiality or envy, as might appeare by my preferring* Salinors *Booke Leſſon, he a Forreiner, before my Country man* Iones *his unexperienced inventions, both ſtrangers to my acqnaintance. Accept therefore, I beſeech your* Excellencie, *this ſmall unworthy Preſent; ſo ſhall I be encouraged with your* Highneſſe *favour and leave, to publiſh my* Treble Architecture, Civill, Military, *and* Marine, *almoſt ready for the Preſſe; if theſe ſpeed with favour, which will impreſt my ſervices, to attend your* Graces *future pleaſure, and engage me to reſt*

Devotedly ready
at your Excellencies
command,

ROBERT NORTON.

THE GUNNERS DIALOGVE.

Question 1.

HOw many things ought a Gunner to vnderſtand, and bee able to performe, before he take upon him the charge of Ordnance?

Anſw. Very many, as to know the Force and Nature, Refining, Cleanſing, Rectifying, and Receits of the Materials, for the making and renewing of Gun-powder. The Names, Proofes, Vſes, Bore, Length, Weight and Fortification of every Peece, and each part thereof. The Vent and Weight of all manner of Shot of any height, Mettall, Stone, or Receipt named; what quantity of any ſort of Powder is due for the loading of each Peece, for any Shot aſſigned, to ſhoot effectually at any Marke within the Peeces Right Range, called Point blanke, or Dead-range, or vtmoſt randon Leuell, Mounted, or Imbaſed, and many others.

Queſt. 2. How ought he to be qualified, and goe provided?

Anſw. With many good parts and needfull things, as reading, writing Arithmeticke to caſt up proportions, Geometry to meaſure lines, ſurfaces and bodies, with Diſcretion to gouerne his many affaires and occaſions, with vigilant and diligent care to keepe ſafe his powder and Ordnance from vntimely miſchances and dangerous accidents: he ſhould not be amongſt his Guns without his Horne furniſhed with Priming powder, and his Caſe with all ſorts of Priming irons, his Sword, Steele, and Tinderbox to light a match at pleaſure, ready to defend himſelfe and his charge from injuries.

Queſt. 3. What are the names, and vſes our vſuall Engliſh Ordnance?

Anſw. Firſt the double Cannon or Cannon of eight inches high, and the whole Cannon or Cannon of 7. inches high in bore, and the Demi-Cannons, and ſecondly the whole and Demy Culuerings, all which are vſed in Batteries, eſpecially the Canons, by reaſon the greater weight of their ſhots doe batter and ſhake a wall or defence, more than lighter ſhot could doe: the Culuerings are moſt commonly to reach farre off, and

yet to beat into a ſtrong oppoſing marke or object, with a large Orifice. Thirdly, the Saker, Minion, Falcon, or Falconet &c ſhooting alſo iron caſt ſhot (as all the forenamed Peeces doe) are to ſhoot at ſtrong and hard reſiſting objects and markes alſo farre off, but the latter being of lower height in bore, ſhooting leſſer ſhot, doe conſequently pierce ſmaller holes then the former. Fourthly, the Periors, as the Canon Perior, Periera, Fowler, Port Peece &c. that ſhoot either ſtone ſhot, murdering ſhot, or Fire-workes, either Cambred, that is, having a leſſer bore backwards, wherein the charge of Pouder is to lye, as the Bambard, Canon Periors, and our Drakes have. Or elſe they are chambred, and having Chambers to put in behind their chaſes to load them with, as the Fouler Port-peece, Slings, Portingale Baſes have.

Q. 4. What and how many are the Simples or Materialls of Gun powder, and their qualities, and how are they to be Refined, and proportionally Mixed or Compounded together?

A. The Simples whereof Pouder is made and compounded, are onely three, namely, Saltpeter, which is the Soule, and Sulpher, which is the Life, and Cole, which is the Body thereof. For the qualities, Saltpeter will rarifie, being fired, and turne into winde, which cauſeth the force. The Sulpher will kindle, and take fire quickly; and the Coale will maintaine the fire and carry them up together. Saltpeter is beſt refined, being diſſolued in a little water, and boiled and ſcummed, being ſet to congeale, it will in part ſhoot like Icles into roch, which is the beſt; the reſt may be either ſo refined againe, or cleanſed from the Feces of greaſe, Alum and ſalt which accompany it. Sulpher is cleanſed by melting it often, and ſtraining it thorow a ſtrong Canuas cloth. The Coale if it be well burned of Alder, Hazle, birch and young wood without barke or knot, will alſo be rectified for the purpoſe. When a quantity of Pouder is to be made, firſt reſolue of the vſe, whether it be for Ordnance, Musket, or Piſtoll: for Ordnance, called Canon Pouder greaſe, or the Receit called foure, one and one. And for the Musket, called Hargubuſſe Pouder, and for Piſtoll fine Pouder, the firſt is of fiue, one and one, the latter of ſix one and one, by which is meant foure, fiue or ſix parts of Peter, to one part of Sulpher, and one part of Coale.

Q. 5. How much Pouder is it fit to allow each Peece for proofe, and for Action?

A. For the Cannons proofe $\frac{1}{7}$ and for ſeruice $\frac{1}{2}$ of the weight of her iron ſhot, for the Culvering and leſſer Ordnance, the whole weight of their proper ſhots for proofe, and for Action for the Culvering $\frac{1}{2}$, and for the Saker and Falcon $\frac{1}{3}$ and for leſſer Peeces the whole weight in Action untill they grow hot, for then muſt abatement be made with diſcretion.

discretion. But in proofe the small Peeces should haue once and ½ of Pouder that the shots weigheth.

Q. 6. What if Ordnance Pouder of 4. I. I. be wanting and yet Hargubusse or fine Pouder be in store, how will you then proportion your Charge?

A. For the

	4. I. I.	5. I. I.	6. I. I.
Canon Double of 8	40 l	37 l ¼	35 l 6 oz
Whole of 7	33 l ¼	31 l ⅓	29 l 7 oz
Demi Cannon	20 l	18 ⅔	17 l 9 oz
Culvering	15 l	13 ¼	13 l
Demi Culvering	7 l	6	5 ¼
Saker	4	3 ½	3 ¼
Minion	3 ½	3 ¼	3 l
Falcon	2 l	1 ¾	1 l 9 oz

Canon Per. ½ of the stone shot in pouder with discretion abating 5 li pro Cent.

Q. 7. If Scales and Ladles be wanting, how many Dyameters of the shots height in pouder will make a reasonable charge for any Peece assigned?

A. For the Cannon 2. ½ for Culuering 3. and for the Saker 3. ½ for lesser Peeces 4 Diametres of the Cillinder. For 3. Diameters make ⅔, and 3 ⅔ make ⅞, and 4 Diametres and ⅛ make the whole weight of a cast iron shot, it being corne pouder, which length will also serue for the measure of Cartredges for the like Peeces.

Q. 8. What proportions are betweene each of those sorts of pouder, namely betweene 4 I. I and 5. I. I. and 6. I. I. concerning their Forces?

A. From the first of 4 I. I. to the second of 5. I. I. the proportion is as 6 to 7, viz. difference. And from the first to the third of 6. I. I. is as 6 to 8, which is ¼, and the second to the third, is as 7 to 8, which is ⅛ in Force augmentingly more.

Q. 9. What are the usuall weights of each shot being either of Lead, Iron, or Stone?

A. I haue here set them seuerally downe in manner of a Table, wherein the first Columne signifieth the height of the Diametre of any shot betweene two and eight inches height, and the parts proceeding from quarter to quarter successiuely.

Inches

Inches,	Lead, 1 li. 11 oz.	Iron, 1 li. 1 oz.	Stone, 0 li. 7 oz.
2	1 li. 11 oz.	1 li. 1 oz.	0 li. 7 oz.
2¼	2 0	1 9	0 9
2½	3 0	2 2	0 12
2¾	4 3	2 14	1 0
3	5 0	3 12	1 4
3¼	6 9	4 12	1 8
3½	8 1	6 2	2 0
3¾	9 14	7 5	2 7
4	11 5	8 10	2 13
4¼	15 15	10 14	3 10
4½	17 15	12 5	4 3
4¾	21 5	14 1	5 9
5	24 12	17 5	6 3
5¼	30 0	20 1	7 8
5½	35 10	23 2	8 14
5¾	39 9	26 6	10 10
6	45 0	30 0	11 4
6¼	51 0	34 0	12 12
6½	57 0	38 0	14 3
6¾	63 0	42 0	15 12
7	72 0	48 0	17 10
7¼	79 8	53 0	19 14
7½	87 0	58 0	21 12
7¾	96 0	64 0	24 0
8	106	72 10	26 12

Q. 10. How much is the height o' the Bore, length of the Chace, weight of the Peece, weight of the pouder, and length of the Ladle, proper to each Peece?

A. I haue also set them downe in a Table for the keeping them the better in memory, as followeth.

Names

Names of the Peeces.	*Height of Bore, Inches.*	*Length in Diameters,*	*Weight in Metall, Pounds,*	*Weight of Pouder,*	*Length of the Ladles Inches.*
Cannon of 8	8	15	8000	40 li	24
Cannon of 7	7	16	7000	25 li	22
Demi Cannon	6½	18	6000	20 li	21
Culvering	5½	28	4500	15 li	20
Demi Culvering	4½	32	2500	9 li	18
Saker	3½	36	1500	5 li ¼	16
Minion	3¼	30	1200	3 li ¾	15
Falcon	2¾	42	700	2 li ½	14
Falconet	2¼	48	500	1 li ¼	12
Cannon Perior	9.10.12	8	3500	3 li 3 li ¼ 4 li	3
Demi Can. Drake	6½	16	3000	9 li	4½
Culvering Drake	5½	16	2000	5 li	4½
Demi Cul. Drake	4½	16	1500	3 li ½	4½
Saker Drake	3½	18	1200	2 li	4½

Q. 11. How and what is it to Tertiate and measure any Peece, and how much ought they to be in thicknes of Mettall at their Touch-holes, Trunions, and Neckes?

A. There are three differences in Fortification of each sort of Ordnance, bee they of the kindes of Cannons, or of Culverings; For they are either ordinarily fortified, or lessened, or double fortified, and common, or Legitimate Peeces, Bastard Peeces, or Extraordinary Peeces. For the Cannon double Fortified, hath fully one Diametre in thicknesse of mettall at her Touch-hole, and $\frac{11}{16}$ at her Trunions, and $\frac{7}{16}$ at her Necke, whereas the ordinary fortified Cannons haue but $\frac{7}{8}$ at the Touch-hole, and $\frac{5}{8}$ at the Trunions, and but $\frac{1}{2}$ at the Necke. And the lessened Cannons haue at the Touch-hole but $\frac{1}{2}$ and at the Trunions $\frac{9}{16}$, and at the Necke $\frac{5}{16}$. Now all the double fortified Culverings, and all lesser Peeces of that kind, haue one diametre and $\frac{1}{4}$ in thicknesse of Mettall at the Touch-hole, and $\frac{13}{16}$ at the Trunions, and $\frac{9}{16}$ at the Necke. And the ordinary fortified Culuerings haue like to the double fortified Cannons, but one diametre of Mettall in thicknesse at the Touch-hole, $\frac{11}{16}$ at the Trunions, and $\frac{7}{16}$ at the Necke. And the lessened Culverings haue $\frac{7}{8}$ at the Touch-hole, and at the Trunions $\frac{5}{8}$, and at the Necke, but $\frac{1}{2}$, as the ordinary fortified Cannons haue.

Q. 12. What are the difference between the Common or Legitimate Peeces, and the Bastard Peeces, and the Extraordinary Peeces?

Common or Legitimate Peeces are such Ordnance as haue a due length of their Chases, proportioned according to the height of their proper Bores, euen as they are expressed in the last precedent Table: Bastard Peeces are such as haue shorter Chases than the proportion of their Bore doth require: and Extraordinary Peeces, are such Ordnance as haue longer Chases than the proportion of the Bore alloweth. And they are called Bastard Culverings, and Extraordinary Culverings, and so Bastard Saker Faulcons or Extraordinary Sakers or Faulcons, &c. accordingly as their Bores come nearest to the Culvering, Saker, or Falcon Bores, &c.

Q. 13. How wil you finde whether a Peece of Ordnance be cleare from Flawes, Crackes, and Hony combes?

A. Hauing first clensed and cleared the Peece with a Wad-hook and Ladle, from all loading, foulenesse, dust and stones, which you may know by putting in the Rammer head vp to the Breech, and with a priming iron put downe into the Touch-hole, if it take hold of the Rammer head, it is cleare of loading and stones, then the Ladle and spung will get out the dust. But to know whether any Crackes, Flawes, or Hony-combes be within her Chase or Chamber, put in an vsuall Searcher, made with two or three springs with points like great pinnes heads, bending outwards, which being bended together with your hand, vntill it will enter into the mouth of the Peece and

that

that put vp to the bottome of the Boze, and turned round in the motion of pulling it in and out of the Chase; so if any Hony-combs be therein, it will sticke with the points in the said Flaw, Crack or Hony-combe. Also in a sun-shine day, with a looking-glasse, the Sunne beams may so be reflected into the Chase, as that all flawes, crackes and spungie Hony-combes may be discerned. Or if the Sun shine not, a Ware candle lighted & put vpon the end of a halfe Pike, or a bright Sword, will also reflect the Sunne-beames, as afore-said. Now if no flaw be found, you may proceed to her proofe, but if any be therein, that Peece is dangerous for breaking, and second lading. and hadneed to be carefully proued, and respectively handled, lest in Lading the second time, any fire remaine therein to enflame the second Charge. Therefore, if any such Peece must needs be vsed, you must not neglect to spunge her well first, with a wet spunge. And also after spunging aduisement taken, not to allow such Peeces the ordinary lading of pouder, but with discretion an abatement must be made, more or lesse, according as the fault or defect is found to be more or lesse.

Q. 14. What if the mouth of a Peece be growne wider then the rest of her Chase within, by meanes of wearing, how will you choose shot fit for her?

A. I will trie with seuerall Rammers heads, or if need be, Face them by little and little, vntill I thereby finde the lowest bore within the Chase (except the Camber be Taper-bored, as the Drakes and some Periors are) and then fit my shot to that lowest bore, alwayes allowing $\frac{1}{10}$ of that height for vent.

Q. 15. What if you be commanded to serve with a Peece that hath lyen long charged, that either the shot is growne fast to the inside of the Peece with rust, or the shot being torted too high, or ovall doth sticke by the way, and so may be dangerous for Peece, and Gunner discharging it?

A. I will not aduenture to discharge a Peece so long loaded, as I may not know what accidents since haue hapned, but with a Wad-hooke will draw the Wad, and try with the Ladle to draw or moue the shot, which if I cannot doe, I will first eleuate her, and powre warme water in at her mouth (and stop the Touch-hole) to dissolue the Petre, and eight or ten houres after, I will vnbase her, (letting a vessell vnder her mouth) to receiue the liquor that shall draine out; then a day or two after I will put in a small quantitie of drie pouder at the Touch-hole, and try if I can blow out the shot therewith, if not, I will then powre in warme oyle and vinegar, and turne her round, so that the vpper side may be side-wise and downwards in that motion; then with her Ladle or Rammer, or both, I shall doubtlesse loosen the shot, and so draw it or blow it out, otherwise the Peece will be euer after vnseruiceable without new founding.

Q. 16. What Instruments are most fit for a Gunners vse?

A. The Callibre Compasses, Height-bord, Inch sight-rule, Gunners Scale, Gunners Quadrant diuided into ninetie degrees, and into twelue points and their minutes, with a Geometricall square to take mountures, leuels, heights, breadths, and distances, and a paire of straight pointed Compasses.

Q. 17. How doe you dispart a Peece or Ordnance, what is it, and to what end vsed?

A. To dispart a Peece, is to finde the difference betweene the Diameters or thicknesse in metall before at the Muzle-ring, and abaft at the Base-ring, for in true bored Peeces the halfe of the difference of their Diametres is the due dispart. Those Diametres are readily found by the Callibre Compasses opened and applied to the opposite sides of those Rings, and to a Scale or Inch-rule of small equall parts, whereby the difference will soone appeare, which halfed is the dispart found. Their Diametres differences also may be found by guirting them with a label of parchment or cord, that will not shrinke nor stretch, diuiding the guirt in three equall parts at each time, it may be tollerably accepted for the Diametre. Also in true equall bored Peeces, putting in a Priming iron at the Touch-hole, to the bottome of the bore, and marking a place vpon it equall in height to the Base-rings highest part, which applied vpon the bottome of the bore at the mouth, perpendicularly, will shew the length of the dispart aboue the highest of the Muzle-ring. Likewise you may finde both those Diametres by laying a rule or straight staffe leuelly, making a Tangent on each of those Rings seuerally, and on each side of the Peece holding a plummet line, so that it onely touch the sides of the mettall of each Ring, the differences betweene those Diametres so found halfed, is the dispart sought. It may be found many other wayes, but these being sufficient, I will only answer concerning the end and vse thereof It serueth to direct the shot to the marke, or so neere as is the distance betweene the two parallels that are made by the two continued lines, the one the Axis of the bore, the other the visuall line that passeth from the Gunners eye by the highest part of the Base-ring and top of the Dispart vnto the marke. For seeing the Breech of the Peece is of solid metall, not so transparant that the Gunner can visually apply the Axis of the bore precisely to the marke, it must suffice to finde the other visuall line, being the neerest that can parallelly be taken thereunto, and accept it, for the same.

Q. 18. How much will you allow for vent, comparing the height of the shot with the height of the bore of the Peece assigned?

A. One twentieth part will be sufficient, approued so to be by the best Gunners of late times, although many Gunners of England generally allow a quarter of an inch for each shot to be lower then the bore

doze of euery Peece, which is too little for a Cannon, but too much for a Falcon, and for lesser Peeces.

Q. 19. What difference is there betweene shooting by the mettall of the Peece, and by the Dispart, to direct a Peece to a marke levell or elevated?

A. Their differences are somewhat uncertaine, because there are seldome any constant proportions held in founding Ordnance, concerning the eminencies of their Base and Muzle rings: but in most peeces they are so, that first laying the Peece to the mark with a due Dispart, & then by the mettall, observing with a Quadrant, you shall sometimes finde that the Peece will be elevated more by the mettall, then by the Dispart, foure degrees, five degrees, yea sometimes six or seuen degrees. And so accordingly will the Randons of the mettall be more then the Randons of the Dispart, which (by the Table of dead Ranges for each degree here annexed, or by the Gunners Scale) may for every elevation be made certainly knowne. But on the levell the mettall rangeth neare double the distance of the Dispart, in most Peeces.

A Table of Randons, or Dead Ranges, for every degree vnto the best Randon, or forty degrees.

Degrees	Paces	Degrees	Paces	Degrees	Paces	Degrees	Paces
1	500	11	1487	21	2125	31	2712
2	610	12	1575	22	2185	32	2747
3	717	13	1655	23	2342	33	2780
4	822	14	1735	24	2397	34	2810
5	925	15	1812	25	2450	35	2837
6	1025	16	1887	26	2500	36	2872
7	1122	17	1960	27	2547	37	2895
8	1218	18	2030	28	2592	38	2920
9	1310	19	2097	29	2635	39	2955
10	1400	20	2162	30	2675	40	2988

Degr	Paces.
41	2990
42	3000

Q. 20. How shall a Gunner know how the Range of his Peece encreaseth, or decreaseth, from degree to degree?

A. First, he must finde by the Table of Right ranges, expresst in the Art of Great Artillery, or otherwise; how much the levell right range of your Peece is, which number of paces divide by 25, and multiply the Quotient by 11, and the product will be the first and greatest digression, which is betweene the first and second degrees, which divide by fortie, the degrees contained betweene the first degree and 42 de-

grees, the beſt or vtmoſt Randon, and the Quotient ſhall be the number of paces that the ſhot ſhall loſe at every digreſſion from degree to degree to the beſt Randon, and contrariwiſe for their increaſing digreſſion from 42 degrees, the vtmoſt Randon downe to the firſt degree.

Q. 21 At how many degrees of Mounture, will any Peece convay her ſhot fartheſt, called her vtmoſt Randon?

A. At about 42. degrees, neuertheleſſe, that 45 hath formerly beene generally taken for the beſt or vtmoſt Randon, being the middle or meane degree betweene the leuell and the perpendicular, namely, the halfe of ninety degrees: But becauſe the Peece on the leuell Rangeth a ſhot about one tenth part of the vtmoſt Randon, as it doth alſo at 84 degrees of Mounture; therefore it ſtands with more reaſon, and experience alſo hath found, that the vtmoſt Randon of any Peece ſhould be (being duly charged and diſcharged) at 42 degrees, the halfe of 84 degrees of eleuation.

Q. 22. How doe you direct your Peece to ſhoot at a marke, being for diſtance, within the Straight line, or Right range of the Peece, and lying levell with the Horizon?

A. Hauing placed the due Diſpart vpon the Muzlering, as in my 17 Anſwer before is ſhewed. Then (both my thumbs being placed cloſe ouer the vppermoſt point or part of the mettall of the Baſe-ring) I will cauſe the Peece to be trauerſed, and coined more or leſſe, vntill I eſpie (thorow betweene my thumbs) the top of the Diſpart and the marke to be in one, and then I giue fire, and expect a good and faire ſhot.

Q. 23. But how will you direct a Peece of Ordnance to ſhot at a marke that lieth levell, but is further diſtant then the Peece can reach vpon her levell Range, you having onely ſome certaine dead range, and the diſtance from that Peece to the marke given; what advantage will you take to reach the marke, to make a faire ſhot at the firſt time?

A. Hauing a certaine Dead range for any eleuation of that Peece giuen, I repaire to my Gunners Scale, or to the laſt precedent Table of Randons or Dead ranges, with the Rule of Proportion, ſaying, if the number of the Paces of the Dead range giuen, doe giue the eleuation giuen, what ſhall the Diſtance giuen, giue; multiply the third number by the ſecond, and diuide the product by the firſt, and the Quotient will be the number of degrees that the Peece muſt be mounted vnto, to reach that marke.

Q. 24. What if the marke be elevated above the levell, and be farther diſtant then the Peece vpon that mounture can reach in a Right range: How will you direct your Peece for advantage, having the Diſtance and ſome certaine Dead range of that Peece given?

A. Firſt, either by my Gunners Scale for degrees, or by the Table following,

following, for the fix points of the Gunners Quadrant, whereby you may ſee the vttermoſt Dead range being 3000 Paces, that the aſpect of the firſt point cutteth the Range of the ſecond point at 1880 Paces of the leuell, and the third Range at 2330 Paces, &c. And that the aſpect of the ſecond point interſecteth the Range of the third point at 1950 Paces.

Aſpect. \ Ranges	1	2	3	4	5
2	1880	0	0	0	0
3	2330	1950	0	0	0
4	2650	2340	1890	0	0
5	2860	2650	2230	1900	0
6	3000	2960	2500	2090	1650

And the Range of the fourth point at 2340, &c. And that the Aſpect of the third point doth interſect the fourth Points Range at 1890 and the fifth Points Range at 2330, and the ſixt at 2500 Paces. And that the Aſpect of the fourth point interſecteth the fifths Range at 1900 Paces, and the ſixths at 2090. And laſtly, that the Aſpect of the fifth point cutteth the ſixths Range at 1650, As the Diagram doth alſo ocularly ſhew.

A. 25. How make you uſe of the Scale and Table?

A. As in the former by the Rule of Proportion, ſaying, if the dead Range giue the Tabular number of dead Ranges proper thereunto, what ſhall the number of the Scale Diagram, or of this Table, proper to the Aſpect and Range cut, giue; multiply the third number by the ſecond, and diuide the product by the firſt, and the Quotient will be the number of Paces proper for the Peece and marke aſſigned.

Q. 26. How will you endeuour to ſhoot farther then ordinary in one and the ſame Peece, with like quantities of pouder and ſhot?

A. Firſt, I will gently put home all the Pouder, and wadde the ſame; then the ſhot being inuolued with paper, leather, okam, or ſuch like, to fill cloſe the concaue of the Boze, I will driue the ſhot cloſe to the Pouder with a good wad, putting after it a Tampion of corke, and with a ſponge a little moiſtened with an oyle, I will annoint the vacant Cillinder of the reſt of the concaue Chaſe; and will ſo barricado the Breach of the Peece with a Pile, wall, or ſuch like, as that it ſhall not reuerſe in the diſcharge: But eſperially, if I

I haue time, I will ſtop the Touch-hole, and drill a new one more forwards, which will make the Pouder all to fire, and ſooner together, and the Peece reuerſeleſſe, if it be rightly done.

Q. 27. What Peece would you chooſe to ſhoot at a ſingle marke, and what courſe will you obſerve?

A. I would chooſe ſuch a Peece as I had formerly practized to ſhoot in, and yet examine her to know her qualities: then inloading her, I will not ramme home her Pouder too hard, leſt it in taking fire lye firſt blowing, and cauſe the Peece to ſtart from her poſition, duly directed by a true diſparture, that the Arts of her Boze may preciſely reſpect the marke. And laſtly endeuour to preuent all impedimentall Accidents.

Q. 28. If you were to make a ſhot in the night, at a marke ſhewed you in the day, how would you prepare for it?

A. I would firſt lay the Peece in her Carriage preciſely to the marke in the day, then with a Chalke-line dipt in Gum-water, I will ſtrike a right line on the vpper part of the mettall from Breech to Muzle (while the line is yet moiſt) vpon which I will apply a good and ſure Magneticall needle or Eye, with a Chart exactly diuided, & note the interſection, then from the ends of the line that was marked or ſtriken vpon the mettall, I let fall plum-lines vpon the Platforme, and at the places where they touch, I knocke in at each a ſmall naile. Laſtly, with a Quadrant I obſerue the eleuation of the concaue: or elſe with ſome Staffe take the perpendicular height of ſome certaine place or marke made in the mettall, as well at the Breech, as at the Muzle aboue the ſaid two nailes: And ſo you may againe lay the Peece thereby, alwayes to haue the ſelfe-ſame poſition, and ſo ſhoot as certaine at that marke by night as by day.

Q. 29. How would you make a ſhot at an Enemies light, in a darke night, not hauing any Candle, Lanthorne, or other light by you?

A. I would light two peeces of match, the one as much longer then the other as the quantity of the diſpart of the Peece, and ſet the longer vpon the vpper part of the Muzle-ring, and the ſhorter vpon the vpper part of the Baſe-ring, trauerſing or coining the Peece vntill I haue brought the light of the Enemies, and the lights of the two matches, all three in one: and ſo I doubt not but to make a good ſhot thereat.

Q. 30. How would you chooſe and order a Peece, to make a good ſhot at a moueable marke: as at an enemies Ship vnder ſaile, Boat rowing, or Horſe-man riding?

A. Firſt I would chooſe ſuch a Peece (as in regard of the diſtance, will be able in a ſtraight line to reach the marke) whoſe qualities I know. Secondly, hauing loaded the Peece, I obſerue how the Marke moueth. Thirdly, I will obſerue the wind (if it blow much) whether

it

it be againſt, or with, me or ſide-waies, and accordingly take aduantage, for the impediment it may produce otherwiſe. Then will I, with the Diſpart conſidered, duely obſerue ſome cloud, or marke ſome point of Landskip that lieth in the courſe of his motion; and when according to the ſwiftneſſe thereof, he is come ſo neere it, as I gueſſe the ſhot and he may meet at the marke, I ſo giue fire, wherein I may remember this ſecret of Nature, that any Peece will ſhoot further from Sea to Land-ward, then from Land to Sea-wards.

Q. 31. What ſay you to ſhooting at a mark and the levell from aboue downwards, how would you order matters to make an effectuall ſhot?

A. That kind of ſhooting is farre more uncertaine and difficile then any other, by reaſon of the ſmaller reſiſtance the ſhot makes againſt the force of the pouder, naturally working upwards, which is towards the Breech, if it were not there reſtrained, it therfore, of all other waies, ſhooteth leaſt diſtance in a ſtraight line, unleſſe it bee perpendicularly downwards, or neerely ſo; beſides no author or Practitioner elſe, to my knowledge, hath diuulged any good vſe or order for the ſame. But I haue obſerued that the Randons for Imbaſures do ſome what neerely decreaſe from degree to degree under the levell, with a double proportion to the decreaſe of the Morter Peeces mounture, aboue from the beſt Random unto ninety degrees. Out of which obſeruation and experience haue framed this Table, and for better helpe added an example.

A Table for Imbaſures.

Degrees,	Paces	Degrees,	Paces	Degrees,	Paces	Degrees,	Paces
0	150	6	137	20	90	60	10
1	149	7	133	30	60	70	6
2	147	8	129	40	40	80	1
3	145	9	125	50	18	90	0
4	142	10	120				
5	139						

The vſe illuſtrated by example.

At eight degrees Imbaſement a ſhot at a marke being to be made with a Saker (for which Peece the Table was made) if the diſtance were leſſe then 129 Paces, then the Peece being able to reach the marke, needs no aduantage: but ſuppoſing it to bee 140 Paces, a leſſe Imbaſement muſt be then giuen, namely, at about ſeuen degrees, to reach the marke, as reaſon will conduce.

Q. 32 Can you make a reasonable shot at a mark, which by reason of interposition of some hill, house, wall, Rampart, or other impediment, you cannot see it?

A. Yes, with a Morter Peece it is usuall if it bee within her reach. And although the carriages of other Peeces, will sew, admit to mount them so high as 20. degrees. yet by sapping the Breech of the Peece, that is, by making a trench for the taile of the carriage to reuerse in, being descended thereinto, the wheeles standing aloft: or by preparing a timber-frame, so that the taile may be sunck, as betweene two Timber-logs squared, the wheeles reuersing upon them, any Peece may bee so mounted to shoot at a mark out of sight, further then any Morter Peece can reach, or by taking a Peece out of her carriage, and mounting her accordingly upon skids at pleasure to the eleuation desired; these may shoot Granadoes, Flaming or Venemous bals, and Hedge-hogs or such like most necessarily. But amongst them the Cannon Periors, Perieraes, and Bombards, are chiefly to be therefore preferred. Hauing then the distance giuen, Stales and Signals are to be placed, to shew where the marke is, which way, and how the shot lighteth short, ouer, or wide, that such errour may at the next time be reformed.

Q. 33. How would you order things, to shoot at a Squadron of the Enemies Souldiers, and what Peeces would you choose?

A. According to the distance I would chuse a Peece that in a straight line can shoot home, if I may, be it with Demy Culvering, Saker, or Falcon, and plant my peece as neere parallel to the champion Plaine as I can, that the shot may range, and shoot at girdle height, unlesse the ground be stony, for then would I place my shot short of them, that grazing amongst the stones, the stones may doe them more spoile then the shot of it selfe can doe, by farre: but in no case would I shoot wide, or ouer them, for that were both losse and shame also.

Q. 34. At the time of joyning of two Armies in Battell, how would you plant and mount your Ordnance?

A. There are divers opinions therein; some say it is best to plant them in the Front, to disorder, the Enemy, and cause them to breake their Ranks at first; which others disliking say, that will hinder their owne party from many advantages, and difficult to retire them: some would plant them in the Flankes: And some would haue some of them in the Front, and some in the Flanke: And lastly, some would haue them behinde the Army, that upon a signe given, their owne Squadrons may open a way for the Gunner to play upon the Enemies Troops or Squadrons. But wheresoeuer they are planted, care must be had, that the Musketiers, appointed for guards, nor any other fire armes, approach within 100. Paces of the Ordnance, least untimely firing them worke mischiefe to the party. But hauing viewed before-hand the place appointed for the Battell if any eminent rising-place bee therenere to lodge

the

the Ordnance thereon, they may thence moſt ſafely play upon the Enemy in Front, Flanke, and Trauers, with wonderfull aduantage and hope of victory.

Q. 35. Having found the firſt ſhot faulty, to the right or left hand, ouer or ſhort, how will you at the next amend it, to make an effectuall ſhot?

A. If it were wide, towards the right or left hand, I would place my eie on the Baſe-ring, at the next time a little more to the ſame ſide, accordingly more or leſſe: if it were too high, direct the Top of the Diſpart vnder the marke as much: if too low, lay ſome ſmall ſtone or ſtraw on the higheſt of the Baſe-ring, and by that lying the diſpart and the Marke into one with diſcretion.

Q. 36. What if the Peece by often ſhooting be growne ſo hot that it is dangerous, vnleſſe it be reſted or refreſhed; how will you coole her?

A. If the ſeruice be ſuch, as ſhe may not haue time to reſt, in that caſe, ſhee muſt be cooled with Spunges wet in Lee, which is beſt, or in vrin and water, or water and vineger, or with the coolеſt freſh or ſalt water; bathing and waſhing her within and without, vntill ſhe bee come to her due temper againe; but if I may, I will reſt her one or two houres in twelue, and betweene whiles coole her euery tenth or twelfth ſhot.

Q. 37. If the Touchhole be cloyed with ſpikes, ſtones, or ſuch like, and neceſſity requireth the vſe of the Peece, what would you doe therein?

A. Not truſt to that which ſome appoint, by beating her on the Muzzle with a wooden mallet, having powred warme oile in at her Touch-hole, to expect her cloying to fly out; nor to the ſetting of her Breech vpright, with her mouth ouer a fire, vntill ſhee be red hot, and then (her mettall being ſoft) to get out her cloying: but if I cannot blow it out, nor haue time to drill another new touch-hole more forwards, I muſt load her with powder and ſhot without wadding, and by a fuſee, wet vent, or powder moiſtned into paſte, placed at the mouth, ſo as it may fire a traine within the Chaſe, that I will there make to fire the charge to auoid danger as much as I can, ſo I will giue fire to the vent, hauing formerly laid my Peece to the marke, as I haue already ſaid.

Q. 38. If you be ſo driuen, that of neceſſity you muſt leaue your Ordnance to the Enemy, what would you doe either with hope to recouer them, or elſe to make them vnſeruiceable, or breake the next time they ſhall bee diſcharged?

A. If I haue no conuenience to hide them ſo ſecretly, by burying them vnder ground, as that the Enemy ſhall not finde them, or be paſt hope that we may neuer come to the place to recouer them: Then would I lay all the Peeces croſſe a narrow ditch or trench, filled ſo with charcoales, or other dry fuell, to kindle and heat them thorowly red hot a good ſpace, which will cauſe the metal to become ſo brittle afterwards, being cold, that they will not be able to endure the due charg of powder to be fired in them, but will breake in peeces at their next diſcharge; or I can breake

them either in that battle place, by applying them with hard ſtrokes of a heavy commander, or by loading each Peece with more then a double charge, and under and about the ſhot driving ſteele wedges with rammers of hard wood, ſo that having fired the Peece with a fuſee, or ſlow pyramid of powder moiſtned like paſte: the ſhot in diſcharge running upon the thicker parts of the wedges will conſtraine the Peece to breake: I know diuers other wayes with a touch to breake or ſpoile the Enemies Ordnance, but I thinke it not fit to ſpeake of it publikely.

Q. 39. Being being, to reſiſt aſſaults and defend the place, what Ordnance are beſt, and where placed, and how uſed?

A. All Ordnance are vſefull, but for defence at a breach or narrow paſſage, Canon Periors, loaded with Lanthornes, filled with pible ſtones, Cales of Baſe and Burre, old iron trafh chaind, langrell, croſſe bar, plugs or any other tearing or murdring ſhot, or with a mine in their way to blow vp and the like: and planting their Ordnance couert ſo, as to ſcower the paſſage from a Flanker Caſſamat or other defence, or before the Breach. Alſo my new inuented Murtherers, that haue long ſquare tapering concaues, which are double or treble in breadth to their heights, and will ſpread their murthering ſhot, Musket or Piſtoll bullets, ſidewiſe far, but little vp and downewards (without feare of ſtop or cloying the Chaſe, as in equall round Peeces oft happneth, when they are charged with ſmall looſe ſhot or trafh) Alſo I will carefully prouide to haue in ſtore, ſpare Carriages, Axtrees, Wheeles, Cordage, Match, Powder, and Shot ſufficient: the rather, becauſe alwayes the Enemies will chiefly endeuour to ruine our Defences, embouch our Loops, beate downe our Parapets and Defences, cloy our Plat-formes, diſmount our Ordnance, teare our Carriages, Axtree and wheeles with their Peeces, by all the meanes they can poſſible.

Q. 40. You having beleagerd or beſieged a Fort or Towne, how would you ſhoot to ruine, annoy, or take away the enemies Defences: and what would you chiefly endevour to doe?

A. Firſt, I would make choice of places to plant my Ordnance, or make my Batteries ſo againſt the weakeſt parts, to make a Breach in the moſt conuenient place, bringing them by Trenches, as neere as I can, within leſſe then two hundred Paces: and then having raiſed and plained the Terraplenes and Parapets, made the Plat-formes, cut and ſet out Loopes, or placed the Gabbions the whilſt, and planted Peeces where they may moſt offend the Enemie, endeuoring to ruine and embouch their Defences, plying them ſo hard, that they may not haue time to repaire the old, nor build new, nor retrench, as they elſe would doe. And alſo make what ſlaughter I can, to weaken the Aduerſary: and from each Battery fit, to ſhoot at the place for Breach, as many Peeces at once as can be brought to beare thereon; and I will

obſerue

obſerue what Peeces of theirs, moſt endammage vs and ours, and endeuour to diſmount them, and amaze and hinder their worꝛkes all I may. The diſtances of the Batteries muſt be accoꝛding as the ſituation of the place will permit, but if poſſible, at eighty, an hundꝛed, oꝛ an hundꝛed and fifty Paces at moſt, auoiding the danger of the Enemies Muſketiers with conuenient Defences: the number of Peeces and the ſoꝛts of them, are to be accoꝛding to the place and the occaſions to vſe them: Cannon, Demy Cannon and Culvering, foꝛ Bꝛeach, and a Demy Culvering oꝛ two, to play vpon the Enemies Defences, with a Field-peece oꝛ two foꝛ ſingle markes. The Bꝛeadth of a Battery muſt be accoꝛding to the length of the Curtine, and the number of Souldiers that muſt giue the aſſault, that nine in a ranke may at leaſt enter together.

Q. 41. What Fire-worꝛkes are moſt ordinary and fit for warlike ſervice, to ſpoile or annoy the Enemy moſt?

A. Granadoes oꝛ hollow bꝛeaking balls of ſeuerall ſoꝛts, Fire-balles foꝛ diuers vſes, as to enlighten the champion, ſticke and burne combuſtible obiects, burne and bꝛeake poiſon, oꝛ blinde the Enemy. burne in the water, oꝛ pierce the fleſh to the bone, where it fired, toucheth, Pouder-pots ſimple and compound, Armed Trunkes, with Piſtols, Fire arꝛowes barbed, Garlands, Rowlers, Fire-pikes, and ſuch like inuentions.

Q. 42. Of what materialls are the Granado-balls made and what receits are they loaded with, and how armed?

A. As they are foꝛ diuers ends (though all to deſtroy the Enemie) ſo they are made of ſeuerall materials, as of Bell-mettall, ſpelter, Iron, oꝛ any hard and bꝛittle mettall. To be ſhot alſo out of a Mꝛtar Peece oꝛ Perior, and may alſo be thꝛowne with the hand amongſt the Enemies: ſome are made of baked Potters clay, oꝛ of Glaſſe, and ſome of Canuas coated and armed: The receits are alſo diuers, as pouder foure ounces, Sulpher two ounces, Saltpetre twelue ounces, finely beaten and well mixed: ſometimes Antimoney and glaſſe, and Scales oꝛ Iron: but let a bꝛittle ball be filled with pouder one pound, within two fingers height, & the reſt with Cannon pouder foure ounces, and Saltpetre twelue ounces, mixt & driuen cloſe together, incloſe this in Cannas, with the mouth oꝛ priming-hole downwards, and fill it, as aball, with pouder two parts, Sulpher one part, & Saltpetre their parts, peirce a hole to fire at, and put into it a pinne of wood, and coat it with Rochfire, oꝛ Roch ſulpher: alſo pouder ℔ li, Peetre 1 li and ½, Sulpher foure ounces is an uſuall receit: they may be made of two hollow Demy Globes of wood, bored full of holes almoſt thꝛough, hauing thence a touch-hole, each hole loaded with a Piſtoll bullet, the concaue filled with fine pouder, and a pipe of wood coated to reach to the bottome, filled with ſlower receipt, they may be loaded with Piſtoll-pines of iron, and pouder, and bullets

at each end, and a touch-hole in the midſt, their coatings may be ſtucke full of ſtones, nailes, ſhot, or ſuch like: Theſe are of great execution, but muſt euer be ſo prouided, that the ſlow fire muſt be ſure to burne vntill the ball fired be arriued at the place where it is to doe its execution: of this kinde there are infinite diuerſities and inuentions.

Q. 43. What is that Roch-ſulpher, and Roch fire?

A. Receipts of much vſe: Roch-ſulpher is made with one pound of Sulpher molten on a ſlow fire, and ¼ li of mealed pouder, put thereto by little and little, and ſtirred well together, and in the cooling put three ounces more of corne pouder, mixing them well together. Roch-fire is made of three pound of Sulpher groſſe beaten, and ſlowly molten, to which put one pound of mutton ſewet, and thereto Pouder and Saltpetre equally mixed, with theſe you may couer, or coat Granadoes Pike, Circles, Balls, Trunkes and Arrowes.

Q. 44. What receipts for Lances, Trunkes and Firepikes vſe you, and how make you them?

A. The formes and receipts alſo are diuers: for one may be of Pouder & Sulpher, of each one pound, Saltpetre three pound, Quikſiluer molten with Sulpeer foure ounces, Glaſſe three ounces, each beaten to pouder, and tempered with Linſeed oile, boiled vntill it will ſcald a feather put therin: theſe put in Canuas, narrow at both ends fitting for Pikes or Arrowes, muſt after be put on, and armed either with Wire, or Parline, and coated with Roch-fire, or other coatings, or Canuas dipped in Pitch and Tallow molten, Sulpher, Rozen, and Turpentine. Lances are little different, onely leſſe: Trunkes are alſo of many ſorts, moſt commonly made of wood, armed with iron hoopes, they may be eighteene inches long, beſides ſix inches bored in for the ſtaffe, which is to be ten or twelue foot long, the eighteene inches bored, two inches and ½ may be filled with Sulpher and Pouder, of each one pound, Quick-ſiluer two ounces, Camphere one ounce, which beat with the Sulphere will become powder, mixe theſe with Linſeede oyle, boyled as aforeſaid, wowld it with Parline, coate it and fill it with a handfull of this receipt, then with a handfull of pouder, then with a button or with ſmall ſhot: couer the end with a waxed or pitched Canuas, hauing a Match or Sulpher three'd goe through all. Another receipt is Cannon pouder, fiue parts refined, Petre three parts, Sulpher two parts, Rozen one part, Camphar, Glaſſe, Amber, and Mallicke mealed and ſearced, of each ½ part, well mixed with oyles of Turpentine, Petre, Linſeed and liquid varniſh of each ½ part Another take Pouder three parts, Sulpher one part, Salpetre three parts, Mallicke one part, Vitrioll, white Ware, of each fiue parts, Amber, Orpiment, Arſenicke, 4 partes, Verdegreaſe, Salarmoniake,

each

each 2 parts, mixt with oyles of Linseed, Petre, Varnish, and Aqua-vite, of each six parts, and well wrought, will be a receipt of great vehemencie in burning.

Q. 45. What are your Fire-balls?

A. They are also of sundry sorts and vses, some to light so, in the night, as to see what the Enemie worketh abroad: make a round ball of Canuas, and fill it either with Powder mealed, Sulpher, Saltpetre, and Roch-sulpher, of each one pound, mixed and prested hard and close, and made round, it being sewed, armed, pierced, primed, and coated with Roch-fire, rowled in corne powder, or with Roch-sulpher molten, 1 li, Saltpetre 2 li, Powder 1 li, and ½ Rozen and Turpentine each ½ li.: these primed through in foure places, and shot out of a Morter or Perior without wad, will take fire and burne very light. Some balls are to burne in the water, for which take of Powder 12 Oz, Sulpher 6 oz, mixt, Campheere 1 oz, pasted with boiled Linseed oyle, and oyle of Turpentine and new Ware, of each 4 oz mixt with coale 4 oz Saltpetre and Roch-fire, of each 1 oz, and ½: this made in a ball, armed, primed, and coated, will not be extinguished by Aire, Winde, nor Water. Another, for a Morter Peece, take a stone shot, lower farre then the Bore, dip it in molten Pitch, Sulpher, Rozen and Turpentine mixed equall parts: then being warme, rowle it in corne powder, with a couer of Fustian dipt in molten Roch-fire, and dip it as at first, rowle it and couer it, vntill it be of fit height for the Peece: lastly, dip it in Roch-fire, and rowle it in fine corne powder, and shoot it out of the Peece without a Wad, loaded with ⅒ of its weight in powder, and priming it downe to the shot with quicke powder.

Q. 46. What are Powder-Pots, Plugges and Cressets?

A. Powder Pots are of baked Potters Clay, or thicke glasse made with foure eares: vnto which Matches lighted at both ends are to be fastned, which filled with powder or quicke receipt, throwne among the Enemie, breakes and takes fire, and makes spoile. Pluggs are to be shot out of Ordnance like billets, but at one end, haue barbed heads of iron to sticke, and at the other, Ropes dipt in Sope-lee, and dried to fly, and not fire: yet the former receipt placed neere the barbed head, will fire any combustible thing it toucheth or sticketh in. Cressets are iron hoopes hanged on poles, to be leuell in all motions, and they are filled with twised match, soaked in Sulpher molten 3 li, Saltpeter 1 li, Rozen 12 oz, Olibanum, and Antimony of each ½ li, and Linseede oyle to incorporate them together: if you will haue them resist wind and raine, fill the hollowes with match well beaten, and soaked in Sulpher and Powder moistned with boiled Linseed oyle, and powder of quicke Lime and Campheere mixed:

And

And fired, it reſiſts wind and water: but to hurt the Enemies eyes, or to poiſon them, or make fleſh fall from the bones, is not fit here to be publiſhed.

Q. 47. What are Fire-workes of Triumph, for pleaſure, and how, and with what receipts and conceits made?

A. The faſhions, inuentions, and compoſitions of them are infinite, but yet they may be doubly diſtinguiſhed as their actions are double, either in the aire or water: thoſe that make their operation in the aire, are either moueable or fixed: the moueable are either ſimple or compounded: the ſimple moueable are the Rockets, the ſimple fixed, are the Trunckes, Lanthorns and Lights, with ſeuerall ſorts of each: The moueables compounded, are the Whæles, Trillers, Courtlaces, Clubs, Targets and flying Dragons: The compound fixed, are the Towers, Caſtle, Arches, Cilinders, Pyramides, and others, which of euery ſort are as infinite, as the variety of inuentions may be infinitly conceiued and wrought. Thoſe that worke their effect in the water, either are fired and placed in it, or kindled by the water it ſelfe, & they do either ſwim on the ſurface, as the Rockets, Tumbling-balls, Serpents, Dolphins, Ships, &c. or elſe burne at the bottome, as many weighty workes doe: ſome of which, when they are lighted, and become lighter then ſo much water, they aſcend, ſwim, and burne aboue.

Q. 48. How are thoſe that operate in the aire, vſually to be made and compounded?

A. The moueable airy Fire-works are either Rockets, or made and contriued with Rockets, they being the ſubſtructure of all the other motions: Rockets are diuerſly framed, either of paper ſix or ſeuen times double, rowled about a former, or they may be of ſtrong light timber turned hollow, or bored, or they may be made of Canuas, in length 6 times the height of their hollowneſſe (if they be vnder the weight of one pound) but if they be of more weight then foure and ½ or fiue Diametres, long will be better. Alſo for ſmall Rockets they muſt haue the quicker receipts, and for great, ſlower: As for example, the receipt for Rockets of foure ounces, may be of pouder 4 li, Salpetre 1 li, Coales 4 oz Sulpher ½ oz: but for Rockets of a pound weight or two, take Salpetre 12 oz, of pouder 20 oz, of Coale 3 oz Sulpher fine and Scales of iron, each 1 oz. and Rockets of 8, 9, or 10 li. weight, to 8 li of Salpetre, put 2 li 12 oz of Coale and 1 li. 4 oz of Sulpher: For in the great ones no pouder muſt be put, note that theſe materials muſt be finely beaten and ſifted thorow a Searce, and well mixed and driuen into the Rochet hard, and filled almoſt to the top euery third or fourth driuing, dipping your drift in Gum Dragagant, and Camphire, diſſolued and mixed with ſpirit of wine, or good Aquauita (if the Rockets be to be fired in three or foure dayes) but if it muſt be a moneth or more firſt: then, in ſtead thereof, dippe the drift ſo in oyle of

Petre

Petre or liquid Varnish and Linseed oyle mixed: if you would have therein any breakers or Buttons, you must within one Diametre of the top drive a bottome of leather, or fir or seuen double of paper, vp to the receipt, and pierce and prime it thorow, there unto in foure or five places: and you must also arme your Cane and bored Rockets least they split: and your flyers must have a straight rod fastned so, that within one or two fingers breadth of the Rocket it may counterpoize the same, for the Runners swiuels or a Cane fastned is sufficient.

Q. 49. How make you the Starres?

A. Take ½ oz of Gum-dragagant and lay it in Crooked-lane black iron plate, and roll it in the embers, till it may be beaten to pouder, then dissolue it in Aquavitæ till it be viscous or slimie, then straine it, and also take 4 oz of Camphær, keepe it 24 houres in other Aquavitæ until it be dissolued, mixe the dissolutions together, & by little and little sprincklingly there with mixe these, poudered Salpetre 1 li, Sulpher ½ li, pouder 3 l, Coales 2 li, Amber and Scales of iron, of each 1 li, and mixe them all ouer a gentle fire of Charte-coales, and marke them in balls as big as you would have them, and rowle them in mealed pouder of Sulpher: you may without the Gumme and Camphære moisten the same pouder, onely with liquid Varnish, Linseed oyle, or oyle of Petre: but the first, is the fairer fire for Starres. The heads of Rockets may be loaded with many things as with pouder strongly lapped and armed in Paper or Parchment, with raining fire, with morcels of Rock-fire or Horse-haires dipped therein molten, Rockets may also be made with Barbes, to stick and burne whatsoeuer they light vpon, and as a shot, they may by a deuice be directed to any place within distance assigned. Now in regard that all moueable Fire-workes, in Aire or Water, have their motions from the force of the Rockets applied accordingly: I neede not speake of them particularly, but leaue each practiser to his owne ingenious inuention.

Q. 50. What are your compositions or receipts for Water, Fires, to burne as well at the top, as at the bottome, and of those that water will kindle, or that will last long fired?

A. Take Wallicke one part, white Incence, Gum Sandrach, quicke Lime, Sulpher, Bitumen, Camphere and Gun-pouder, of each three parts Rozen two parts, and Salpetre nine parts. The Camphær must be beaten either with Sulpher, Salt, Almonds, or water, else it will not be mealed. This will burne and feed vpon in the water. But to make a receipt to burne at the bottome, fill a ball with this receipt, Take Salpetre, ½ li, mealed powder 9. ounces, refined Sulpher 1. l. and ½ Camphære beaten with Sulpher and Quick-siluer, put and stirred into the Sulpher a little molten, all mealed and mixed by hand, & filled into a round Canuas ball, by little and little, and wel driuen, being first moistned with oyle of Petre, or Linseed oyle boiled, vntill it will scalda feather: then arme the Ball, and

prime it, ballast it with Lead at the bottome, that the vent may burne vpwards, or a stone to make it, and (hauing fired it well) throw it into the water, and it will burne at the bottome therof, and fume and boile vp slow. Now for as much as all the before-named fire-workes, both moueable and fired, are but by the applications of these or the like, I shall not need (neither is it possible) to particular all the inuentions and varieties that may be made therin: I will therfore conclude, omitting also perfumed sauours and venomous scents that may be made in Fire-workes, as not fit to be here reuealed. Next for such receipts as the water it selfe will kindle, they are made of oyle Benedict one pound, boiled Linseed oyle three pounds, oyle of the yolkes of Egges one pound, new Quick-lime eight pounds, Sulpher two pound, Camphor foure ounces, and Bitumen two ounces. Or else Roch-Petre one pound, flowres of Sulpher nine ounces, Coales of Rotten-wood six ounces, Camphor one ounce and ½, oyle of Egges, and oyle Benedict sufficent to paste the mixture, with new burnt Lime vnsleyked two pound, Or vnsleikt Lime, Tutia, Roch-Petre, Loadstone, of each one part, Sulpher, Viue and Champhor, of each, two eight parts, put these things in a pot filled with quick-lime in powder and lute, and arme it well with strong wires, and set it in a Lime-kill a whole burning time, & the materialls will become a stone that any moisture will kindle. A receipt to carry fire alwayes in a mans pocket, is this: Take Cow-dung steeped foure or fiue times in spirits of Wine or Aquauita, three times distilled, wherein Champhor must be dissolued; this must be well dried, being made into a Ball and kindled, it will last many dayes: it must be couered halfe an inch thick with vnsleiked Lime, and the white of Egges well mired. and when you will vse it, make a hole with a priming iron, and put a Sulpher match vnto it, and it will light: And so Salpetre mixt with the powder of the coales of Juniper, and the white of an Egge, will a long time last kindled.

FINIS.

¶ The Table of the contents of this Booke, called The Arte of shooting in great Ordnance.

First, tenne principall things to be considered in the shooting of Ordnance 10.5.

1. Pouder the goodnesse or badnesse. ibid.
2. The lading of the peece. ibid.
3. The winde. ibid.
4. The shot. ibid.
5. The wadde or pouder too hard or too loose ibid.
6. The standing of the peece. ibid.
7. Of shooting vp the hill, or downe the hill. ibid.
8. Of the length of the peece. ibid.
9. Of the disparting of the peece. ibid.
10. Whether the peece be truely bored. ibid.

Now beginneth the first Chapter of the Booke, called the Arte of shooting in Great Ordnance, and first as concerning pouder. 7.

The 2. Chapter sheweth, how to know whether any peece of Ordnance be truely bored, by the help of certaine instruments. 8.

The 3. Chapter sheweth, how much pouder will serve any peece of Ordnance by the weight of the peeces, and weight of the shot, and at the end of this Chapter there is a Table that doth declare the weight of iron shot. 9.

The 4. Chapter sheweth how to disspart any peece of Ordnance truly. 13.

The 5 Chapter sheweth how to give levell with any peece of Ordnance to make a shot, according as the most sorts of Gunners doe vse to doe, although that there is no arte in it. 15.

The 6. Chapter sheweth what a degree is. 16.

The 7. Chapter sheweth how to make a shot vpon the right line, and so how to know how much ground that any peece of Ordnance doth drive or convey a shot at the mount of every degree of the Randare. 18.

The 8. Chapter sheweth, how to mount any peece of Ordnance by the degree with an inch rule, with a table, shewing what part of an inch rule will make one degree, and so vnto ten degrees. 22.

The 9. Chapter sheweth, what manner of course the shot flieth in the ayre. 28.

The 10. Chapter sheweth, how to mount a Morter peece, for to lay the shot at any distance a ointed. 30.

The 11. Chapter is how far above the marke the shot flieth over the marke by the length of the peece, and distance vnto the marke. 31.

The 12. Chapter is how to make a perfect shot with a peece that is not truly bored, that is to say, that the core or hollownesse goeth not right in the middle of the mettall. 32.

The 13 Chapter is how to give levell at a marke vpon a hill or valley with the Quadrant. 34.

The

The 14. Chapter is how to make a perfit ſhot upon the land, at the broad ſide of a ſhip that is vnder ſaile, and going. 36.

The 15. Chapter is, how to make a ſhot out of one ſhip into another, although the Sea be wrought, or out of a Galley into a ſhip. 37.

The 16. Chapter ſheweth vnto you in what order you ſhould place Ordnance in ſhips 40.

The 17. Chapter ſheweth vnto you how for to ſhoot at a moveable marke vpon the land, and alſo what kind of ſhot is the beſt to be vſed according vnto the cauſe. 42.

The 18. Chapter ſheweth, how you ſhall know if any peece of Ordnance be ſufficiently mettalled, and alſo the cauſe that the Cannons doe not occupie the weight in powder that the ſhot weigheth. 43.

The 19. Chapter ſheweth in what order you ſhall give levell with your Ordnance at a batterie, to beate downe the walles of any place, and alſo, what to obſerve in giving fire vnto them. 44.

The 20. Chapter, ſheweth the weight of all manner of caſt peeces of Ordnance, from the Cannon, unto the Faulconnet, and alſo the weight of the ſhot, and the weight of the pouder that they do occupie with the height of the ſhot, and length of the peece, and all ſuch other like cauſes, according vnto the names of the peeces. 45.

The 21. Chapter ſheweth, how many ſhots of pouder there is in a laſt of pouder, from the Cannon, unto the Fauconet, and alſo, if you be at any battery orin any towne, Caſtle or ſhip, how to know how much pouder will ſhoot all your Ordnance off. 49.

The 22. Chapter ſheweth, how to know how many ſhot doth weigh a Tunne. 53.

The 23. Chapter ſheweth how and by what order the ſhot doth graze or glance upon the land or water. 55.

The 24. Chapter is, how for to batter the walles of any Towne, as well by night as by day. 56.

The 25. Chapter doth declare how to plant Ordnance by night, to batter the walles of any Towne, or diſplace any Ordnance, in any Bulwarkes, or any ſuch other like, as well by night as by day. 61.

The 26. Chapter doth declare how for to keepe a Haven or River on the Sea coaſt for to ſincke a ſhip, as well by night as by day in all points. 64.

FINIS.

L 121 B